

**CONTRACTING OFFICER'S REPRESENTATIVE
APPOINTMENT LETTER**

Date 05 October 2015

From: Vanessa Seymour
To: Peter Morrison

Subj: Appointment as Contracting Officer's Representative
COR)

Ref: (a) DFARS 201.602-2
(b) DFARS PGI 201.602-2
(c) ONRINST 4205.2C

1. Pursuant to references (a) through (c), you are hereby appointed as the Contracting Officer's Representative (COR) for the administration of the following contract/order:

Contract Number: N00014-16-C-1009

For: Laser Weapon System Demonstrator (LWSD) Program

Name of Contractor: Northrop Grumman Systems Corporation,
Aerospace Systems, One Space Park Drive, Redondo Beach, CA 90278

Contract Period: Thirty-three (33) months: Base-24 months and include the acquisition of Long Lead Items. Period of Performance is October 07, 2015 through October 06, 2017; Option I-15 months and overlaps base period from September 01, 2016 through November 30, 2017; Option II-8 months with Period of Performance November 01, 2017 through June 30, 2018; Option III-9 months with Period of Performance October 07, 2015 through July 06, 2018.

2. You are authorized by this designation to take action with respect to the following:

a. Verify that the contractor performs the technical requirements of the contract in accordance with the contract terms, conditions and specifications. Specific emphasis should be placed on the quality provisions, for both adherence to the contract provisions and to the contractor's own quality control program, if applicable.

b. Perform, or cause to be performed, inspections necessary in connection with paragraph 2.a and verify that the contractor has corrected all deficiencies. Perform acceptance for the Government of services performed under this contract. You are the designated Government Official to receive and certify invoices for payment in the appropriate DFAS office (usually via Wide Area Workflow). It is understood that you have taken the required training at www.wawftraining.com. You are advised that all invoices shall be reviewed as to completeness, accuracy and in accordance with the contract as awarded and by signing the acceptance, you are attesting that the invoice is valid and accurate.

c. Maintain liaison and direct communications with the contractor. Written communications with the contractor and other documents pertaining to the contract shall be signed as "Contracting Officer's Representative" and a copy shall be furnished to the contracting officer.

d. Monitor the contractor's performance; notify the contractor of deficiencies observed during surveillance and direct appropriate action to effect correction. Record and report to the PCO incidents of faulty or nonconforming work, delays or problems.

e. Coordinate site entry for contractor personnel, and ensure that any Government-furnished property is available when required.

3. You are not empowered to award, agree to or sign any contract (including delivery orders) or contract modifications or in any way obligate the payment of money by the Government. You may not take any action which may affect contract or delivery order schedules, funds or scope. The Procuring Contracting Officer (PCO) shall make all contractual agreements, commitments or modifications that involve price, quantity, quality, delivery schedules or other terms and conditions of the contract. You may be personally liable for unauthorized acts. You may not re-delegate your COR authority.

4. This designation as a COR shall remain in effect through the life of the contract, unless revoked sooner in writing by the PCO or unless you are separated from Government service. If you are to be reassigned or to be separated from Government service, you shall notify the PCO sufficiently in advance of reassignment or separation to permit timely selection and designation of a successor COR. If your designation is revoked for any reason before completion of this contract, turn your records over to the successor COR or obtain disposition instructions from the PCO.

5. You are required to maintain adequate records to sufficiently describe the performance of your duties as a COR during the life of this contract and to dispose of such records as directed by the PCO. As a minimum, the COR file must contain the following:

a. A copy of your letter of appointment from the PCO, or any amendments thereto.

b. A copy of the contract or the appropriate part of the contract and all contract modifications.

c. A copy of the applicable quality assurance (QA) surveillance plan.

d. All correspondence pertaining to this contract, including Memorandums of Record for meetings, contractor discussions, etc.

e. The names and position titles of individuals who serve on the contract administration team. The PCO must approve all those who serve on this team.

f. A record of inspections performed and results.

**ALTERNATE CONTRACTING OFFICER'S REPRESENTATIVE (ACOR)
APPOINTMENT LETTER**

Date 25 September 2015

From: Vanessa Seymour, ONR 251
To: Gerald Manke, NSWC Crane Division

Subj: Appointment as Alternate Contracting Officer's Representative

Ref: (a) DFARS 201.602-2
(b) DFARS PGI 201.602-2
(c) ONRINST 4205.2C

1. Pursuant to references (a) through (c), you are hereby appointed as the Alternate Contracting Officer's Representative (ACOR) for the administration of the following contract/order:

Contract Number: N00014-16-C-1009

For: Laser Weapon System Demonstrator (LWSD) Program

Name of Contractor: Northrop Grumman Systems Corporation,
Aerospace Systems, One Space Park Drive, Redondo Beach, CA 90278

Contract Period: Thirty-three (33) months: Base-24 months and include the acquisition of Long Lead Items. Period of Performance is October 01, 2015 through September 30, 2017; Option I-15 months and overlaps base period from September 01, 2016 through November 30, 2017; Option II-8 months with Period of Performance November 01, 2017 through June 30, 2018; Option III-9 months with Period of Performance October 01, 2015 through June 30, 2018.

2. You are authorized by this designation to take action for the Contracting Officer Representative (COR) with respect to the following:

a. Verify that the contractor performs the technical requirements of the contract in accordance with the contract terms, conditions and specifications. Specific emphasis should be placed on the quality provisions, for both adherence to the contract provisions and to the contractor's own quality control program, if applicable.

b. Perform, or cause to be performed, inspections necessary in connection with paragraph 2.a and verify that the contractor has corrected all deficiencies. Perform acceptance for the Government of services performed under this contract. You are the designated Government Official to receive and certify invoices for payment in the appropriate DFAS office (usually via Wide Area Workflow). It is understood that you have taken the required training at www.wawftraining.com. You are advised that all invoices shall be reviewed as to completeness, accuracy and in accordance with the contract as awarded and by signing the acceptance, you are attesting that the invoice is valid and accurate.

c. Maintain liaison and direct communications with the contractor. Written communications with the contractor and other documents pertaining to the contract shall be signed as "Alternate Contracting Officer's Representative (ACOR)" and a copy shall be furnished to both the COR and the contracting officer (KO).

d. Monitor the contractor's performance; notify the COR of any noted deficiencies observed during surveillance and direct appropriate action to effect correction. Record and report to the PCO incidents of faulty or nonconforming work, delays or problems.

e. Coordinate site entry for contractor personnel, and ensure that any Government-furnished property is available when required.

3. You are not empowered to award, agree to or sign any contract (including delivery orders) or contract modifications or in any way obligate the payment of money by the Government. You may not take any action which may affect contract or delivery order schedules, funds or scope. The Procuring Contracting Officer (PCO) shall make all contractual agreements, commitments or modifications that involve price, quantity, quality, delivery schedules or other terms and conditions of the contract. You may be personally liable for unauthorized acts. You may not re-delegate your ACOR authority.

4. This designation as a ACOR shall remain in effect through the life of the contract, unless revoked sooner in writing by the COR, PCO or unless you are separated from Government service. If you are to be reassigned or to be separated from Government service, you shall notify the COR and PCO sufficiently in advance of reassignment or separation to permit timely selection and designation of a successor ACOR. If your designation is revoked for any reason before completion of this contract, turn your records over to COR or obtain other disposition instructions from the PCO.

5. You are required to maintain adequate records to sufficiently describe the performance of your duties as a COR during the life of this contract and to dispose of such records as directed by the PCO. As a minimum, the ACOR file must contain the following:

a. A copy of this letter and a copy of your letter of appointment from the PCO, with any amendments thereto.

b. A copy of the contract or the appropriate part of the contract and all contract modifications.

c. A copy of the applicable quality assurance (QA) surveillance plan, when developed.

d. All correspondence pertaining to this contract, including Memorandums of Record for meetings, contractor discussions, etc.

e. The names and position titles of individuals who serve on the contract administration team. The PCO must approve all those who serve on this team.

f. A record of any inspections performed as ACOR and results.

g. Memoranda for record or minutes of any pre-performance conferences.

h. Memoranda for record of minutes of any meetings and discussions with the contractor or others pertaining to the contract or contract performance.

i. Records relating to the contractor's quality control system and plan and the results of the quality control effort.

j. Documentation pertaining to your acceptance of performance of services, including reports and other data.

6. All Government personnel engaged in contracting and related activities shall conduct business dealings with industry in a manner above reproach in every aspect and shall protect the U.S. Government's interest, as well as maintain its reputation for fair and equal dealings with all contractors. DoD 5500.7-R sets forth standards of conduct for all personnel directly and indirectly involved in contracting.

7. An ACOR who may have direct or indirect financial interest which would place the ACOR in a position where there is a conflict between the ACOR's private interests and public interests of the United States shall advise the COR, supervisor and PCO of the conflict so the appropriate actions may be taken. COR and ACOR's shall avoid the appearance of a conflict of interest to maintain public confidence in the U.S. Government's conduct of business with the private sector.

8. You are required to acknowledge receipt of this designation on the duplicate copy and return it to me. Your signature also serves as certification that you have read and understand the contents of DoD 5500.7-R. The original copy of this designation should be retained in your file.

9. If you have any questions regarding this nomination, please contact the undersigned Contracting Officer at (telephone number), or e-mail at (e-mail address).

(b) (6)

A large black rectangular redaction box covering the signature area of the Contracting Officer.

Contracting Officer

ACOR ACKNOWLEDGEMENT:

I have read, understand and shall comply with the ACOR Appointment Letter and the Joint Ethics Regulation DOD 5500.7R. I have completed and provided evidence of the required training. I understand that the above duties will be added to my performance objectives and be evaluated during my rating period. I also understand that I do not have the authority to obligate the government.

COR Name: GERALD MANKE
Title: SENIOR SCIENTIST, NSWC Crane
E-mail: gerald.manke@navy.mil

Date: 25 SEPTEMBER 2015
Phone: (812) 854-3686

Signature:

(b) (6)

Note: Please sign one copy of this memorandum in the space provided, and return to both the Contracting Officer/Contract Specialist who will upload it into the CORT Tool, and Contracting Officer Representative (COR).

COR ACKNOWLEDGEMENT:

I have read, understand and shall comply with the COR Appointment Letter and the Joint Ethics Regulation DOD 5500.7R. I have completed and provided evidence of the required training. I understand that the above duties will be added to my performance objectives and be evaluated during my rating period. I also understand that I do not have the authority to obligate the government.

COR Name: PETER A. MORRISON
Title: PROGRAM OFFICER, ONR 352
E-mail: peter.a.morrison@navy.mil

Date: 05 OCTOBER 2015
Phone: 703-696-0553

Signature:

(b)(7)

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Note: Please sign one copy of this memorandum in the space provided, and return to the Contracting Officer/Contract Specialist, who will upload it into the CORT Tool.

NORTHROP GRUMMAN SYSTEMS CORPORATION, AEROSPACE SYSTEMS

INDIVIDUAL SUBCONTRACTING PLAN FOR PRIME CONTRACT NUMBER

N00014-16-C-1009

SMALL/SMALL DISADVANTAGED BUSINESS CONCERNS

WOMEN-OWNED SMALL BUSINESS CONCERNS

HUBZONE SMALL BUSINESS CONCERNS

HISTORICALLY BLACK COLLEGES AND UNIVERSITIES/MINORITY INSTITUTIONS

VETERAN-OWNED, SERVICE DISABLED VETERAN-OWNED SMALL BUSINESS CONCERNS NATIVE AMERICAN

ALASKAN NATIVE CORPORATIONS, AND INDIAN TRIBES

LASER WEAPON SYSTEMS DEMONSTRATOR (LWSD) PROGRAM

SUBMITTAL DATE:

10-19-2015

CONTRACT NO:

N00014-16-C-1009

SALES DOCUMENT NO:

CUN NO:

0001, 0002, 0003, 0004, 0005, 0006

POC SEND (S&T)

guy@northropgrumman.com

Attn: Mark Miller

0002

REVISION:

08-11-2015

SUPERSEDES REVISION (A/C/F)

BROAD AGENCY ANNOUNCEMENT NO.:

ONRDAAS-0005

PERIOD OF PERFORMANCE

10-22-2015 TO 10-21-2016

MODIFICATION DATE

N/A

AGENCY:

DOD

COMMAND/BRANCH:

U.S. NAVY OFFICE OF NAVAL RESEARCH (ONR)

CAGE CODE:

11552 REDONDO BEACH, CA

It shall not be disclosed outside the government and shall not be duplicated, used, or disclosed in whole or in part, for any purpose other than to evaluate the proposal. Provided that a contract is awarded to this offer or as a result of, or in connection with the submission of this data, the government shall have the right to duplicate, use, or disclose the data to the extent provided in the contract. This restriction does not limit the government's right to use information in the data if it is obtained from another source without restriction. The data subject to this restriction is contained in the direct and indirect goal computations and the Master Subcontracting Plan.

PREPARED BY:

(b) (6)

Lee, Paul D (AS)

Small Business Liaison Officer

Global Supplier Diversity Programs Office

Date

CONCURRENCE:

(b) (6)

Rena, Guy D (AS)

Program Manager

Date

APPROVED BY:

(b) (6)

Harzer-Hall, Vicky (AS)

Sector Manager Aerospace Systems

Global Supplier Diversity Programs Office

Date

APPROVED BY:

(b) (6)

Rackstraw, Robert (AS)

Contract Manager

Date

Program Name	LASER WEAPON SYSTEM DEMONSTRATOR (LWSD) PROGRAM	Date
Contract Number	N00014-16-C-1009	10/23/2016

Revision Number	Revision Date	Description of Change	Change Page
0001	8/11/2015	Submit Date Updated to 08-11-2015	1
0001	8/11/2015	Revision Number changed from "NEW" to "0001"	1
0001	8/11/2015	Supersedes Revision Dated updated to "01-27-2015"	1
0001	8/11/2015	Modification Date updated to "08-11-2015"	1
0001	8/11/2015	POP Updated to "10-01-2015 to 09-30-2018"	1, 3
0001	8/11/2015	Change Log Incorporated	2
0001	8/11/2015	Description of Effort Updated	3
0001	8/11/2015	Projected Goals Revised to address Cost Proposal Revision	4
0002	10/19/2015	Prime Contract Number N00014-16-C-1009 Incorporated	1
0002	10/19/2015	Submit Date Updated to "10-19-2015"	1
0002	10/19/2015	Revision Number changed from "0001" to "0002"	1
0002	10/19/2015	Supersedes Revision Dated updated to "08-11-2015"	1
0002	10/19/2015	Modification Date updated to "N/A"	1
0002	10/19/2015	POP Updated to "10-22-2015 to 10-21-2018"	1, 3
0002	10/19/2015	Projected Goals Revised to address Negotiated Contract Value	4
0002	10/19/2015	Footer Updated to address incorporated Contract Number	All
0002	10/19/2015	Change Log Updated	2

INDIVIDUAL SUBCONTRACTING PLAN

This is the Addendum Sheet to the approved Master Subcontracting Plan for Northrop Grumman Systems Corporation, Aerospace Systems (NGSCAS) sector effective 1 January 2013 through 31 January 2016. The estimated period of performance for this effort is 22 October 2015 through 21 October 2018. After award of this program, NGSCAS sector will review and update the Individual Subcontracting Plan (ISP) accordingly.

DESCRIPTION OF EFFORT

NGSCAS sector is pleased to submit this Small Business Subcontracting Plan for Laser Weapon Systems Demonstrator (LWSD) Program. This plan is fully responsive to the requirements of Broad Agency Announcement No. ONRBAA15-0005 and is compliant with Federal Acquisition Regulation (FAR) 52.218-9.

An ISP was previously submitted with our original offer at the beginning of the year and a revised ISP was submitted with NGSCAS's cost proposal revision. This revision addresses the negotiated contract value.

The purpose of the Solid State, High Power Laser Weapon System Demonstrator (LWSD) Program is to design, build, test and demonstrate a LWSD consisting of a Tactical Laser Core Module (TLCM) integrated with government-furnished elements and subsystems to mature system, sub-system, and component technologies. The NG team (herein after referred to as "The Contractor") will work with the government during the Phase I Design, Risk Reduction, and Long Lead to mature the TLCM design proposed through detailed design and risk reduction activities leading to selection and procurement of long lead material, components, and assemblies. In the Phase II option, the TLCM design will be implemented through system fabrication, assembly, and test and then integrated with GFE to create the LWSD which will be validated through Land Based Testing (LBT). The Phase II option will conclude with pier-side delivery of the LWSD in the sea-based test configuration for integration onto the Self Defense Test Ship (SDTS). The Phase III option will consist of support from The Contractor to the government for integration of the LWSD onto SDTS and subsequent support of Sea-Based Testing (SBT).

See Table below for breakdown of CLINE.

NO.	TITLE	DESCRIPTION	PERIOD OF PERFORMANCE	CONTRACT TYPE
0001	Phase I – 150 kW Baseline	Design Risk Reduction	10/22/2015 - 10/21/2016	CPI-F
0002	Phase I – 150 kW LL Parts	Long Lead Parts	10/22/2015 - 1/21/2017	CPFF
0003	Phase II – Option	Fac, Land Based Test (LBT)	9/22/2016 - 12/21/2017	CPFF
0004	Phase II – Option Hardware	Demo Hardware Delivery (NSP)	9/22/2016 - 12/21/2017	CPFF
0005	Phase II – Option II	Installation and SBT	1/22/2017 - 10/21/2018	CPFF
0006	Engineering Studies	Unfunded O&M for Individual Studies that may be requested by ONR on an as needed basis	10/22/2015 - 10/21/2016	CPI-F

PROJECTED GOALS 150kW BASELINE (DIRECT, INDIRECT, AND SUBTOTAL)*

Contract Value	\$ 91,057,597			\$ 91,057,597		
Subcont. Value	\$ (b) (4)			\$ (b) (4)		
Business Codes	Projected Goals (no prior contracts) For 10-27-2015 to 10-24-2018	Subcont. %	Contr. %	Projected Indirect Calculation for LWSD Program 150 kW Baseline	New Goals For LWSD Program 150 kW Baseline	Subcont. %
Small	\$ (b) (4)	(b) (4)	(b) (4)	\$ (b) (4)	\$ (b) (4)	(b) (4)
Large	\$ (b) (4)	(b) (4)	(b) (4)	\$ (b) (4)	\$ (b) (4)	(b) (4)
Total	\$ (b) (4)	(b) (4)	(b) (4)	\$ (b) (4)	\$ (b) (4)	(b) (4)
SDE	\$ (b) (4)	(b) (4)	(b) (4)	\$ (b) (4)	\$ (b) (4)	(b) (4)
WOSB	\$ (b) (4)	(b) (4)	(b) (4)	\$ (b) (4)	\$ (b) (4)	(b) (4)
HIDCUMW	\$ -	(b) (4)	(b) (4)	\$ -	\$ -	(b) (4)
HUBZone	\$ (b) (4)	(b) (4)	(b) (4)	\$ (b) (4)	\$ (b) (4)	(b) (4)
VOSB	\$ (b) (4)	(b) (4)	(b) (4)	\$ (b) (4)	\$ (b) (4)	(b) (4)
SDVOSB	\$ (b) (4)	(b) (4)	(b) (4)	\$ (b) (4)	\$ (b) (4)	(b) (4)
NA	\$ (b) (4)	(b) (4)	(b) (4)	\$ (b) (4)	\$ (b) (4)	(b) (4)
ANC	\$ -	(b) (4)	(b) (4)	\$ -	\$ -	(b) (4)
IT	\$ -	(b) (4)	(b) (4)	\$ -	\$ -	(b) (4)

*Contract Value includes CLINs 0001, 0002, 0003, 0004, 0005, & 0006. Subcontract Value is Just for Baseline.

Note: In accordance with FAR 52.219 requirements of this solicitation or modification, subcontracting goals are expressed as a percentage of total subcontract (and contract value for all business concerns. Prior to 1 June 2008, N2S/CAS sector adhered to Comprehensive Subcontracting Plan in which separate program goals were not required. Effective 01 April 2011 a portion of indirect commitments will be allocated to all new and/or revised individual subcontracting plans (ISPs). Indirect allocation will only be applied to the current revised subcontract portion of the contract. It is not retroactive. These costs will be allocated to this contract on a proportionate basis of the contract value as a portion of total sales. These costs will be allocated to this contract on a proportionate basis of the contract value as a portion of total sales. Goals are required for new subcontracts, contracts, or modifications that exceed \$650K beginning on or after 1 October 2010. All figures have been rounded to the nearest dollar.

SUPPLIERS

Below is a list of potential suppliers and services that Northrop Grumman Systems Corporation, Aerospace Systems sector may utilize for **Laser Weapon Systems Demonstrator (LWSD) Program**. It is possible for a company to be classified in more than one category.

Company Name	City and State	NAICS Code	Products and Services	SMALL	LARGE	SDB	WOSB	HBCU/MI	HUBZone	VOSB	SDVOSB	NA	AWC	IT
ABE Engineering Co.	Whittier, CA	541811	Admin Mgt. / Gen. Mgt. Consulting	X			X							
Acopian Technical Company	Easton, PA	335899	Power Supply	X										
AR Tech	Fontana, CA	314812	Copper Bag	X		X	X							
Brugg Crane Service	Long Beach, CA	236800	Crane/Drew-Haul		X									
CB Mfg. & Eng. Inc.	Santa Ana, CA	332710	Interface Plate	X			X							
Chemical Strategies Inc.	Arlisle, CA	427890	Paint/Primer	X										
Cornerstone Metals & Machining Inc.	Santa Paula, CA	332710	Base Plate Assembly Brackets	X		X								
Hulen Corporation	Santa Fe Springs, CA	423510	Metals Service Centers	X		X								
Meadowgate Technologies, LLC	Greenville, NJ	423130	Electronic Parts	X					X	X	X			
MLI Technologies	Mountain View, CA	336317	Optics/Coatings	X										
Nextec OE	Fremont, CA	336314	Online Fiber Polarizer	X		X								
Nuforn	East Granby, CT	336421	Fiber Amplifier		X									
Engineer's Products Corporation	Saginaw, MI	336212	Jack	X			X							
Stazuli Corporation	Duncan, SC	641712	Blind-Mate Connectors		X									
O-Pass Inc.	Bedford, MA	336890	Track Illuminator	X										
Wenzel Engineering	Rancho Dominguez, CA	541310	Laser Weapon Structure	X										

Northrop Grumman Systems Corporation, Aerospace Systems sector will continue to build upon its long established tradition of working with small and minority development associations, through its Outreach Program in order to develop a valid and dynamic source list. In addition to participating in qualified small businesses procurement conferences, Global Supplier Diversity Programs Office representatives and procurement personnel attend trade fairs and community development programs for SBs, SDBs, WOSBs, HUBZones, VOSBs, SDVOSBs and ANCs.

Emphasis is placed on subcontracting work to companies that represent underutilized business categories (i.e. SB, SDB, WOSB, HUBZone, and SDVOSB). As a "best practice", NGSCAS sector will continue efforts and research to include all categories of Small Business concerns.

It should be noted that this Addendum to the Master Subcontracting Plan incorporates the most current available Small Business categories, including Small, Small Disadvantaged, Woman-Owned, HBCU/MI, HUBZone, Service-Disabled Veteran-Owned, Veteran-Owned, Native American, Alaskan Native Corporations and Indian Tribes.

Justification:

NGAS utilizes internal websites and market research websites to identify small business concerns such as US SBA Dynamic Small Business Search, Northrop Grumman's Supplier Intelligence Database, System for Award Management, and others. NGAS' goal is lower because several of their suppliers have grown out of the SDB category and are now considered just small businesses. As of March 31, 2015, NGAS has achieved 100% satisfaction in their SB and VOSB percentages. NGAS has also achieved more than 50% satisfaction on all other small business categories. NGAS will continue to seek and provide the maximum practicable subcontracting opportunities to Small Business, SDB, WOSB, HUBZ, VOSB, and SDVOSB concerns.

STATEMENT OF WORK
SOLID STATE, HIGH POWER LASER WEAPON SYSTEM DEMONSTRATOR
(LWSD)

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1.0 SCOPE/OBJECTIVE

1.1 BACKGROUND

The Office of Naval Research (ONR) funded the Maritime Laser Demonstrator (MLD) which was the first to demonstrate defeat of small boats at sea using a High Energy Laser (HEL). Recent advancements in the power and durability of commercially available Solid State Laser (SSL) technologies have enabled the Navy to execute a quick-reaction effort and operationally field an SSL weapon. The Navy Laser Weapon System (LaWS) AN/SEQ-3(XN-1) was installed on the USS Ponce in the summer of 2014. After a series of test and certification steps, LaWS is now the first-ever fully approved laser weapon system deployed by any United States military service. The Office of Naval Research seeks to continue the advancement of SSL weapon system designs, architectures, and component technologies. The Government believes that improvements in lethality may be achieved through maturation and optimization of a variety of system characteristics, including laser power, beam quality, beam director architecture, and other physical and optical aspects of the laser, beam director, and system design.

1.2 SCOPE

The purpose of the Solid State, High Power Laser Weapon System Demonstrator Program is to design, build, test and demonstrate a LWSD consisting of a Tactical Laser Core Module (TLCM) integrated with Government-furnished elements and subsystems to mature system, subsystem, and component technologies. The NG team (herein after referred to as 'Contractor') will work with the Government during the base period (Phase I) Design, Risk Reduction, and Long Lead to mature the TLCM design proposed through detailed design and risk reduction activities leading to selection and procurement of long lead material, components, and assemblies. During Option I (Phase II), the TLCM design will be implemented through system fabrication, assembly, and test. The Contractor will work with the Government to integrate the TLCM with Government Furnished Equipment (GFE) to create the LWSD which will be validated through Land Based Testing (LBT). The Government led Contractor and Government teaming environment will be accomplished by consolidating System Engineering and Subsystem Integrated Product Team members under one organizational structure. Option I will conclude with pier-side delivery of the LWSD in the sea-based test configuration for integration onto the Self Defense Test Ship (SDTS). Option II (Phase III) will consist of support from the Contractor to the Government for integration of the LWSD onto SDTS and subsequent support of Sea-Based Testing (SBT). Option III will consist of additional research studies, evaluations, and additional spares and analyses.

1.3 OBJECTIVES

The LWSD program has the following objectives, which the Contractor shall support through Government led studies and Contractor design and construction of the TLCM

- Balanced approaches to technology maturation and system designs that implement cost-effective trade-offs between laser power, beam quality, optical path, duty cycle, aperture, mechanical robustness, and other physical/optical attributes of the TLCM system to achieve enhanced lethality, integration, sustainability and reliability over previous demonstrations and prototypes;

-
- Mechanically robust and efficient laser systems;
 - Systems that provide scalable architectures for both lower and higher power level capabilities;
 - System designs that allow for adjustable power on target to provide a range of effects from deny to disrupt, damage, and defeat;
 - Laser sub-systems with beam attributes (divergence, beam quality, etc.) consistent with predictive avoidance requirements;
 - Maturation of beam director and tracking technologies to achieve low jitter performance;
 - System configurations that can sustain long-term exposure to the maritime environment and the Navy's operational environment (corrosion, shock, vibration, moisture, electromagnetic environmental effects, etc.);
 - Engagements and sensing of single and multiple targets (serially) in both daytime and nighttime operations at tactically significant ranges;
 - Tracking and targeting capabilities relevant to the following missions:
 - Counter Fast Attack Craft/Fast Inshore Attack Craft (FAC/FIAC)
 - Counter Unmanned Aerial Vehicle (UAV)
 - Counter Intelligence, Surveillance and Reconnaissance (ISR)
 - Combat Identification
 - Operates for at least one (1) month of testing at sea with minimal manpower and maintenance requirements;
 - Capability to be installed and tested on the Self Defense Test Ship (SDTS), the USS Paul Foster (cDD-964);
 - Meets all Navy safety requirements for installation and operation;
 - Integrates with required Government Furnished Equipment (GFE);
 - Provides interfaces for a Virtual Test Bed representing the Navy's Combat System; and
 - Design principles utilized consistent with size, weight and power (SWaP) and configuration to enable future re-installation on a DDG-51 Flt IIA (baseline design).
 - Support Government led studies for design alternatives that potentially impact size, weight and power (SWaP) and configuration to enable future reinstallation of the baselined TLM design and LWSD on other alternative naval ship classes.

As the TLM is integrated into the LWSD, the TLM must work and function cooperatively with other elements of the LWSD in order to achieve these objectives.

1.4 LWSD REFERENCE DOCUMENTS, FUNCTIONAL WORKGROUPS (WG) AND INTEGRATED PRODUCT TEAMS (IPT)

Section 4.3 includes the Government Furnished Information (GFI) which was listed in ONRBAA 15-0005 Appendix A. Additional documentation including Interface Documents will be matured and updated through interactions between the Government and the Contractor over

the life of the contract. The following GFI includes guidance and references required for successful program execution with respect to software development:

1. Assistant Secretary of the Navy for Research, Development and Acquisition (ASN (RDA)) Guidebook for Acquisition of Naval Software Intensive Systems - Version 1.0 (Sept 2008)
2. ISO/IEC 12207-2008 - Systems and Software Engineering - Software Life Cycle Processes (2nd Edition 2008-02-01)

1.5 LWSD DEFINITIONS

The Laser Weapon System Demonstrator (LWSD) is the complete laser weapon system including the TLCM; Power & Cooling Subsystem (PCS); Auxiliary Mission Support Equipment (AMSE), not including the SDTS; and any installed Mission Specific Modules (MSMs) to include any cabling, connections, fixtures or interfaces required to physically connect the Contractor furnished TLCM to the GFE which will permit required weapons functions to be completed and both land based and sea based tests conducted at government operated test sites under government direction. (See ONRBAA 15-0005, page 6, Figure 1).

1.5.1 Tactical Laser Core Module (TLCM)

The TLCM is the Contractor furnished equipment comprised of five subsystems, including the interfaces and cabling or conduits required to connect to any Government Furnished Equipment (GFE) that comprises the LWSD:

- Beam Director Subsystem (BDS)
 - BDS is a marinized gimbaled telescope that expands, focuses, and directs the high energy laser beam. The main telescope is also used to direct the Track Illuminator Laser (TIL) and is used as a receiving telescope for two shared aperture cameras. In addition to the main telescope the BDS has two off-boresight imaging sensors. The BDS supports up to three Mission Specific Modules (MSMs) mounted on a fixture that rotates with the Line-of-Sight (LOS). To support several Targeting and Tracking Subsystem (TTS) functions, BDS provides internal interfaces for several TTS sensors and an alignment laser. The BDS has a controller to manage the input gimbal pointing and velocity demands. The BDS has a built-in window washing system for routine cleaning.
- Targeting and Tracking Subsystem (TTS)
 - TTS provides all the tracking functions associated with the TLCM and the LWSD (which is separate from any ancillary tracking functions associated with the laser weapon console (LWC) or mission specific modules/MSMs) including those for weapons and target tracking applications, to include but not limited to tracking, providing the high-resolution image data used for ISR, managing beam alignment and stabilization of the beam path, implementing the commanded aimpoint designation, and performing automatic aimpoint maintenance.
- Fire Control Subsystem (FCS)

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- The FCS locally manages the TLM for release of high energy laser power. FCS is the TLM primary interface with the Laser Weapon Console (LWC) and its associated GFE software with interface to the Surrogate Combat System Virtual Test Bed (VTB) and Hybrid Predictive Avoidance Safety System (HPASS). FCS manages all the state and mode transitions of associated TLM subsystems and their related LWSD subsystems to monitor and report the health and status of the TLM and LWSD when connected to the Laser Weapon Console. When not available from the Surrogate Combat System Virtual Test Bed (VTB), the FCS provides time services, video distribution services, data recording services and position services (GPS) for the rest of the TLM system and reports these through the Laser Weapon Console.
 - Laser Subsystem (LS)
 - The LS generates the main HEL beam, and is attached to the GFE Energy Storage Module (ESM) Subsystem and GFE Thermal Storage Skid (TSS) Subsystem. The LS includes a Hard Wired Abort System (HWAS) that inhibits and shuts down the HEL when any safety hazard or off nominal operation is detected. The HWAS aggregates several external discrete signal lines to support external aborts, and reports these conditions through the GFE Laser Weapon Console (LWC).
 - Structure and Support Subsystem (SSS)
 - The SSS provides the mechanical structures that integrate the TLM subsystems, vibration isolation, contamination control system (that provides positive dry air pressure or equivalent) for the High Energy Laser (HEL) beam path, enclosures for the TLM system, environmental control for the enclosures and the trailer for road transport. The SSS also provides interfaces from the GFE Power and Cooling Subsystem (TSS and ESM) to the rest of the subsystems through cooling manifolds and power cables.

1.5.2 Power & Cooling Subsystem (PCS)

The PCS is not part of the TLM but consists of two GFE assemblies:

- Energy Storage Module (ESM), Quantity 1.
- Thermal Storage Skid (TSS), Quantity 1.

The PCS will be integrated with the TLM by the Contractor.

1.5.3 Auxiliary Mission Support Equipment (AMSE)

The AMSE is the GFE and Government support systems needed to operate the LWSD. The AMSE includes:

- Hybrid Predictive Avoidance Safety System (HPASS)
- Laser Weapon Console (LWC) station
- Solid State Laser Virtual Test Bed (Surrogate Combat System)
- Self Defense Test Ship (SDTS), the USS Paul Foster (eDD-964)

The HPASS, LWC, and Combat System will be integrated with the TLM by the Government led Contractor supported Integrated Program Team (IPT). The LWSD will be integrated on the SDTS by the Government with support from the Contractor.

1.5.4 Mission Specific Module (MSM)

An MSM is a GFE assembly meeting the interface requirements specified in 'Solid State Laser Mission Specific Module Interface Functional Description', version 1.1, dated 17 December 2014. MSMs can be selected and installed to temporarily add capability to the LWSD to address specific missions of interest.

1.6 DEFINITION OF ASSOCIATED PROCESSES TO LASER WEAPON SYSTEM DEMONSTRATOR (LWSD) DESIGN, DEVELOPMENT, FABRICATION AND TEST

1.6.1 Fabrication, Assembly, and Test (FA&T)

FA&T as referenced in this SOW is the subsystem level fabrication of components and assemblies and then integration of the assemblies into a complete subsystem for subsystem testing.

1.6.2 Integration and Test (I&T)

I&T as referenced in this SOW is the Contractor led LWSD level integration of the TLCDM, PCS, and AMSE (without ship) subsystems into a complete LWSD and the factory testing necessary to demonstrate the LWSD is ready for field testing.

1.6.3 Test and Evaluation (T&E)

T&E as referenced in this SOW is the Government led LWSD system level field testing and analysis required to evaluate the test results to demonstrate the LWSD meets the program objectives. The Government plans a safety-conscious program with a logical progression from design and risk reduction through fabrication and assembly, with initial land-based testing to validate system performance, and culminating in meeting the program objective in a test or set of tests at-sea.

1.6.4 Land Based Testing

The Land Based Tests (LBTs) shall be conducted on a Government facility in order to validate the performance of the beam control system and validate the overall performance of the TLCDM when integrated with other subsystems that comprise the LWSD. Conducting the LBTs requires considerable preparation of technical and a number of readiness reviews which shall be conducted by the government to ensure that the LWSD is ready for actual testing, meeting all check out, range safety and environmental requirements. Readiness reviews associated with the LBT include reviews by the Navy's Laser Safety Review Board (LSRB) and the Weapon Systems Explosive Safety Review Board (WSESRB) as a part of government test range approval processes and are included in pretest review activities. Specifically, "Land Based Test One" (LBT1) is identified as a critical risk reduction test series exercising the beam director, tracking and targeting systems, and verifying that the LWC/HPASS functions properly. LBT1 is not expected to include the SSL subsystem operated at high power levels. LBT1 provides the Objective Qualifying Evidence (OQE) required by the Government to confirm that the LWSD can be safely operated, and safely certify the conduct of a second land based test (LBT2). LBT2, the system level performance testing, will exercise the full weapon capability, including the high power SSL for targets below and above the horizon. LBT2 is expected to include targeting, tracking, aim-point maintenance and test firings to confirm duty cycle and power performance metrics firing against representative surface and air targets on (or over) water, within an at-sea

test range. The time separation between LBT1 and LBT2 will depend on the maturity level of the integrated TLM and LWSD subsystems and scheduling of available government test ranges. LBT2 builds on the results of LBT1 and supports the data collection and OQE requirement for a tailored shipboard Test Readiness Review (TRR) to be conducted by the government. Additional details of the land based testing are documented in the Test and Evaluation Strategy (TES) and expected to be developed further in the SSL-TM Master Test and Evaluation Plan (MTEP).

In order to ensure adequate testing preparation, initial versions of the operating and maintenance manuals for the LWSD need to be developed prior to LBT1. LBT1 and LBT2 are expected to be conducted on-site at a shore-based "open air" government test range and aimed over water at surface and air targets. The Government currently envisions that each test series will last two (2) weeks. It is expected that the Contractor shall be primarily responsible for operating the laser during Phase II testing, with support from the Government with a government operator at the laser weapon console (LWC).

1.6.5 Sea Based Testing

After Land Based Tests (LBT1 & 2), and successfully completing a test readiness review (TRR) the TLM and associated LWSD subsystems shall be prepared for installation and testing at sea. The purpose of the sea based testing series is to extend confirmation and validation of Objective Qualifying Evidence (OQE) against the in Requirements Verification Traceability Matrix (RVTM) in the maritime environment. Two series of Sea Based Tests (SBT1 and 2) are anticipated to be conducted by the government under the SSL-TM program. At present, two initial Sea Based Tests (SBT1A & SBT1B) are to be conducted under this contract and identified as separate, but similar tests series. Each SBT is expected to be two-weeks in duration, separated by approximately six (6) weeks in which the LWSD system remains installed on the ship. Testing length and separation shall be determined by program decisions, needs and local test range conditions.

In order to conduct the SBTs, the LWSD (and TLM) is expected to be lifted by dock-side cranes and installed and interconnected to the USS Paul Foster (DD-964) otherwise known as the Self Defense Test Ship (SDTS). These efforts shall be a significant part of a government led effort in Phase III of the contract. The LWSD shall then be tested while the SDTS is underway and testing shall include multiple GFE test articles (both surface and air targets) in order to collect OQE. The contractor's "as built" documentation of the TLM and associated LWSD subsystems, as well as final operating and maintenance manuals are expected to form the basis for conducting the SBTs and collecting the OQE. Following SBTs, the LWSD shall be de-installed from the SDTS. Data collected from SBTs shall be shared with the contractor as required to confirm OQE. Details of sea based testing plans are documented in the Government Furnished Information provided Test and Evaluation Strategy (TES) document and expected to be developed in the SSL-TM Master Test and Evaluation Plan (MTEP).

2.0 REQUIREMENTS

The proposed LWSD program work is broken down into logical and efficient Work Breakdown Structure (WBS) elements that match with the Contractor management approach and defined IPTs to meet the LWSD objectives. IPTs will be created for each of the five subsystems defined for the TLM and shall be made up of contractor and government staff. Leadership of these five subsystem IPTs shall be determined by the contractor. The Contractor shall integrate these IPTs into the Government led IPT Structure.

2.1 BASE: PHASE I – TACTICAL LASER CORE MODULE SUBSYSTEM (TLCM) DESIGN, RISK REDUCTION, AND LONG LEAD

The LWSD Phase I provides for the detailed design of the TLCM. The TLCM detailed design includes the engineering analysis required for the detailed design of the five TLCM subsystems including accommodation of Government Furnished Equipment (GFE) as well as support of the Government's detailed planning for integration & test and test & evaluation activities through the sea-based demonstration. The design begins with detailed System Engineering requirements flow down and analysis culminating in a System Requirements Review (SRR). Following SRR, preliminary design activity based on the proposed concept will culminate in a Preliminary Design Review (PDR). At the conclusion of the preliminary design activity, final detailed design of the five TLCM subsystems will be completed to a sufficient level for a Critical Design Review (CDR). As subsystem designs mature and upon review and approval by the Government, long lead procurements will commence based on delivery schedule estimates and integration need dates. The Contractor shall deliver a critical long lead item list to the Government for approval no later than SRR. Tasks within Phase I are divided into two level 3 WBS elements which are the Subsystem Detailed Design and the Program Management and System Engineering, Integration and Test (SEIT). The SEIT WBS elements will be incorporated into the consolidated Government led SEIT IPT consisting of Government and Contractor System Engineers. The Subsystem detailed design is composed of one subtask for each of the five (5) subsystems. Program Management and SEIT have four subtasks plus additional subtasks to cover safety, security, and design reviews.

Task 1.1 – Program Management. The Contractor shall perform program management including conducting a Phase I kickoff/ Baseline Review at ONR, a System Requirements Review (SRR) at the Contractor's facility, a Preliminary Design Review (PDR) at ONR, and a Critical Design Review (CDR) at The Contractor facility and prepare and submit deliverables.

The Contractor shall prepare and submit program deliverables as specified at Exhibit A of this contract. The kickoff/baseline review will establish the Phase I baseline Integrated Master Schedule (IMS) and Integrated Master Plan (IMP) and ensure they are in line with the Government's requirements. The Contractor shall submit monthly status reports summarizing Contractor activities and financial status. Regularly scheduled program reviews and regular updates to Technical Data Package (TDP) shall include updates to the IMS, review presentation materials, and any adjustments to anticipated technical activities for Phase II and/or Phase III with associated budgetary adjustments to cost and schedule estimates, to be further defined and addressed via engineering change proposal at the start of Phase II. IPT meetings, Technical Exchange Meetings (TEMs) and Functional Area Working Group Meetings shall be conducted as required by program tempo determined by risk assessment and program concerns. Also, functional workgroups (WG) and IPTs are expected to be formed at the subsystem, TLCM and LWSD levels. Establishment of functional working groups (WG) may be formed by the Contractor or the Government, at the subsystem, TLCM or LSWD level, or at a Program level to enable good working relationships and interactions. Workgroups may be Government or industry led, and may include industry, government or representatives from both as determined by need. Integrated Product Teams (IPTs) however are composed of specific representatives from appropriate functional disciplines (government and/or industry) working together to build successful programs, are meant to identify and resolve specific issues, and make sound and timely recommendations to facilitate decision making at the program level. Any IPT (contractor or government led) shall develop and have an approved charter signed by the Contracting Officer

Representative (COR) identifying composition, responsibilities (to or for), tasking schedules and any deliverables. There are three types of IPTs: Overarching IPTs (OIPs) that focus on strategic guidance, program assessment, and issue resolution; Working-level IPTs (WIPTs) that identify and resolve program issues, determine program status, and seek opportunities for acquisition reform (separate from the less formal workgroups or more rigid control boards); and Program-level IPTs (PIPTs) that focus on program execution and may include representatives from both government and industry after contract award. Additional guidance on WGs and IPTs may be found in the Defense Acquisition Guidebook in Chapter 10. (See information available at: <https://acc.dau.mil/dag10.3#10.3>) Meetings will be conducted via teleconference when possible, or at a facility as required to permit discussion and review of any required design documentation or hardware activities. In general, IPTs will record attendees, minutes, status, actions and resolutions to past actions, while WG will only record attendees and meeting minutes (which may include technical, timeline or workload discussions).

The Contractor shall perform program management functions necessary to ensure program health, objectives, risks, and tasks are executed on-schedule and within budget. The Contractor shall provide the contractual communication and management of TLMC subcontractors. The Contractor shall provide business management including financial control and reporting. The Contractor shall attend and participate in the Government led LWS Configuration Control Board (CCB) to maintain and control the TLMC configuration including review of changes affecting form, fit, or function of any subsystem or Interface Control Document (ICD), and elevation to an ECP. The Contractor shall establish, maintain and chair a TLMC CCB to maintain and control the TLMC configuration including review of changes internal to the TLMC affecting form, fit, or function of any subsystem or ICD, and elevation to the LWS CCB. The Contractor led TLMC CCB shall report any and all changes for review through TLMC CCB meeting minutes and through TLMC CCB presentations made to the overarching LWS CCB.

The Government (COR) shall establish and the Government and Contractor shall convene jointly attended Material Review Boards (MRB) and Failure Review Boards (FRB) as deemed necessary to investigate failures during risk reduction, manufacturing, and system test activities. The Contractor shall chair TLMC MRB and FRB meetings and Contractor standard MRB and FRB processes shall be utilized to collect, analyze, and record failures that occur within the TLMC, TLMC subsystems and TLMC components being developed, integrated, and tested.

The MRB shall review and report on any discrepancies that arise during subsystem fabrication, assembly, and test to the Government. The FRB shall review failures that occur after subsystem delivery for TLMC integration and report them to the COR. In both cases the process to establish root cause and corrective action shall be well-defined, with reporting shared by both Contractor and Government staff – and those related to safety shall be shared verbally without reservations or delay. Government concurrence with all MRB and FRB findings via a Government representative seated on each board shall be required. The Contractor shall provide visibility and access (but not necessarily transfer of ownership), as specified in Sec. 2.5, to all available software products as required for review, e.g. safety, regardless of data rights or ultimate ownership. The Government representative will be provided ten (10) days advance notice of any upcoming board meetings requiring in-person attendance. The Contractor shall provide minutes from these board meetings, as a deliverable to the Government.

All failures shall be reported in writing to the COR, and any which may affect safety or safe operations shall be reported to the COR within twenty-four (24) hours. Should the COR identify safety criticality related to any failure of a material or non-material (e.g. software) product, the

Government led Failure Review Board will hold precedence over any failed hardware or data collected. All failure testing shall be potentially overseen by Government subject matter staff.

Task 1.2 – Visits and Access. The Contractor shall provide Government representatives with reasonable facilities and equipment, and access to all areas essential to the proper conduct of reviews, IPT meetings, Technical Exchange Meetings (TEMs) and Functional Area Working Group Meetings. U.S. Government representatives will meet the Contractor's security and export control requirements.

Task 1.3 – Security. The Contractor shall provide technical and management support for the implementation, and adherence to security policies and procedures based on the DD Form 254, Security Classification Specification and associated Security Classification Guidance.

Task 1.4 – System Engineering. All LWSD System Engineering efforts will be managed by a consolidated System Engineering Integration and Test (SEIT) IPT, chaired by a Government Lead System Engineer (LSE), and staffed by Government and Contractor System Engineers. The Contractor shall perform system design to provide requirements allocation and support interface control between the subsystems, address requirements generation, manage software and hardware development, and manage risk – both technical and programmatic for the TLCM system. The Contractor shall document and deliver these efforts in the Systems Engineering Plan (SEP).

Task 1.4.1 TLCM Design, Requirements Allocation and Subsystem Interface Control

For requirements traceability and verification status accounting, the Contractor and the Government shall maintain up-to-date DOORS (Dynamic Object Oriented Requirements System) databases (one each for LWSD and TLCM). In order of importance are the aspects of these DOORS database accuracy, distribution, and timeliness. The Contractor TLCM DOORS database updates shall occur on a frequency defined by the Government led SEIT IPT. The SEIT IPT will set the update frequency based on program activity (SRR, PDR, CDR, etc) and level of requirements stability. For example, the Contractor TLCM DOORS database updates initially are expected to occur on highly frequent basis (from Kick Off through SFR/SRR in Phase I, with daily or near daily updates) and then updates are expected to grow less frequent (every-other day to weekly in the latter half of Phase I through PDR/CDR, and in Phase II, becoming weekly updates and then monthly updates, respectively) and ultimately only required on an “as needed” basis (in Phase III).

The Government's “System of Systems” LWSD level DOORS system shall be maintained on the Naval Systems Engineering Resource Center (NSERC) file sharing site. Requirements from the LWSD DOORS shall be provided by the government to the contractor to support development of the TLCM DOORS database on an as needed basis. The government will export LWSD DOORS information needed for the TLCM DOORS initiation into a MicroSoft Excel spreadsheet file, with the resulting XLS file being imported into the TLCM DOORS database. Updates to the LWSD DOORS would be similarly exported as XLS files, and imported into the TLCM DOORS database on an as needed basis.

The Contractor's TLCM specific DOORS database shall be accomplished by one of three means, to be down-selected at the Kickoff Meeting:

- a) The Contractors TLCM DOORS database would be supported on the Navy's NSERC file sharing site. Access to NSERC and the Government DOORS software can only be enabled with issuance of individual contractor Common

Access Cards (CAC). Contractors with access would manipulate, upload and download any specific information from the TLCM DOORS database as required from the NSERC for TLCM design and to meet requirements definition needs.

- b) Alternatively, the contractor may elect to provide access to the Government to their TLCM DOORS database from their Contractor supplied servers. Methods and access to the Government staff requiring access would be determined collaboratively at the Kickoff Meeting, and provided to the Government identified representatives.
- c) Alternatively, duplicate TLCM DOORS databases would be supported at both the Navy's NSERC file sharing site and on the Contractor servers. Manual file exchanges would be accomplished through electronic file exchange, allowing the Government to establish and maintain a duplicate TLCM DOORS baseline. The Contractor would then export their DOORS change information made to that baseline into a MicroSoft Excel spreadsheet file, with the resulting XLS file being sent to the Government identified DOORS representative to import this XLS update/change file into the TLCM DOORS database as established at the Kickoff Meeting. A method of checking the TLCM DOORS databases for consistency and data accuracy (e.g. MD5 checksum) shall be required and agreed to at the Kickoff Meeting, if duplicate Contractor/Government DOORS databases are maintained.

Should DOORS file exchange or synchronization approaches prove time consuming or unable to meet accuracy and low data latency needs, a DOORS working group of Government and Contractor members will be established to examine and establish methods of "best practices" in order to ensure data accuracy, distribution, and timeliness – and minimize any potential cost impacts for the TLCM DOORS database development.

The LWSD DOORS Database attributes and traceability methods will be defined by the Government. For system level architecture, the Government and Contractor shall use the MagicDraw tool on a Navy fileserver. This shall include the software and physical decomposition of the TLCM as a component of the TDP.

Interfaces with subsystems external to the TLCM shall be defined jointly with the Government and will be configuration controlled in the MagicDraw database. The Contractor shall produce final versions of TLCM requirements specifications at the CDR. In coordination with the Government LSI (Lead System Integrator) the Contractor shall establish and track top level Technical Performance Metrics (TPMs) and Interface Control Documents (ICDs).

The Contractor shall report TPM status at regularly scheduled program reviews and in regular updates to the Technical Data Package. Technical performance of the TLCM system and subsystems shall be the responsibility of the Contractor, while any interfaces to the government furnished equipment and government furnished information shall be the responsibility of the government. Also, TLCM performance may rely on associated LWSD interfaces and design elements. Therefore additional details regarding specific interface technical performance, detail and associated responsibilities shall be developed jointly and documented as the program executes in the government's Systems Engineering Plan (SEP) for the LWSD. This Statement of Work (SOW) shall provide initial guidance on the division of responsibilities and workload between government and contractor where applicable.

In particular, as a requirement and within DOORS, the Contractor shall include the measurement of laser properties in accordance with 'HEL JTO A Beam Quality Metric for High Energy Lasers', 30 July 2014, and shall be tracked as a Technical Performance Metric (TPM) and measured against the provided power curves included with the proposed design (Reference Northrop Grumman Proposal Letter, NG # SK-A23C-DAG-15-001 dated 27 JAN 2015, Technical Proposal, Tab #1 Technical Approach and Justification, Section 1.2.1.1.3.4 PIB Curves and Key System Parameters, pages 10-11 including classified addendum) .

The Contractor shall develop and deliver updated Interface Control Documents (ICD) related to the TLCM. In particular, the Contractor shall produce and deliver specific ICD related to interfaces between each TLCM subsystem, with identification of associated Objective Qualifying Evidence (OQEs) and metrics. Metrics and associated data provided in the ICD shall be considered to be delivered with unlimited rights, unless otherwise specified. Should other than unlimited rights be identified, the contractor shall explain how it intends to meet objectives or achieve the TLCM/LWSD goals and requirements - if the government receives less than unlimited rights. The Contractor shall track predicted subsystem performance against allocated requirements and the intended OQEs. The Contractor shall perform analyses, modeling activities, and perform system trades sufficient to establish performance of the TLCM and LWSD associated performance as designed against the required missions. The Contractor shall share Modeling and Simulation (M&S) inputs and methodology with the Government's M&S Subject Matter Expert(s). Data and results of analysis provided to the Government with a general description of the software used in the analysis shall be considered as deliverables to the Government with unlimited rights as defined in the Defense Federal Acquisition Regulations Supplement (DFARS), and would include the identification of any limited rights and/or restricted rights (as applicable) with the analysis techniques used – which shall be limited to those techniques, and not extend to the provided data sets delivered to the Government. The Government shall retain unlimited data rights on any Government Furnished Equipment and Government Furnished Information, regardless of the interfaced hardware or software provided by the Contractor.

Task 1.4.2 TLCM Hardware and Software Development

The Contractor shall develop and deliver initial and updated operation and control software (including firmware) associated with any TLCM and associated LWSD hardware to be delivered. Software development by the Contractor shall be in accordance with reference 1, ASN (RDA), 'Guidebook for Acquisition of Naval Software Intensive Systems', Version 1.0 Sept 2008, and reference 2, 'ISO/IEC 12207-2008 - Systems and Software Engineering - Software Life Cycle Processes', 2nd Edition 2008-02-01, to ensure compatibility with Navy software development planning for the LWSD. The Government will follow DOD INSTRUCTION 8500.2, Dated 06 February 2003 as released by the Assistant Secretary for Defense, ASD(C3I) under the subject of "Information Assurance (IA) Implementation". However, recent Navy implementations through the CYBERSAFE program indicate that the DOD Information Assurance Certification and Accreditation Process (DIACAP) is expected to be replaced in FY 16 with a new risk management framework (RMF) for reporting and obtaining Interim Authority to Test (IATT) approvals. Therefore, the Contractor and the Government will both be required to support the development of any cyber and information assurance documentation required by the RMF and associated with obtaining the required IATTs. At present, two IATTs packages are expected to be required, one for land based testing, and one for

sea based testing. The Contractor shall support the development of any TLCM documentation package needed by the Government required by either CYBERSAFE or for the approval of the IATT for the LWSD in either the land or sea based testing configurations in the support of DODI 8500.2. As additional developments occur, the Government shall provide the Contractor with updates on CYBERSAFE and RMF and the government developments of IATT packages to be submitted for land and sea based testing.

For software, to ensure safe operations and cross development compatibility, as specified in Section 2.5, the Contractor shall provide, and ensure that its Subcontractors provide, the Government reasonable access to, and visibility for, software and firmware development and execution, including source code and resulting products, for all software in all TLCM systems, sub-systems and line replaceable units (LRUs).

The Contractor shall ensure that all required cybersecurity and information assurance tasks for software and firmware products maintain a commensurate level of Cybersecurity accreditation as required under the Information Assurance Policy Updates provided by the Department of Navy Chief Information Officer (DON/CIO) (Reference DON CIO Memo 02-10 of 26 Apr 2010 "Information Assurance Policy Update").

The Contractor shall provide all executable or compiled code delivered as part of the TLCM or associated LWSD deliverables (see associated Contract Data Requirements List or CDRL items) with a paid up, unlimited use license to the Government, in perpetuity. The executable and compiled code delivered, and for which the license is provided, must be a result of the source code review and remain otherwise, unmodified.

The Government shall have access to and retain any Drawings, Data, Management Information, or Technical Data necessary to assess the status of, operate, maintain, or repair the TLCM, in perpetuity. All such data delivered shall be considered by the government as having unlimited use rights unless specifically identified and traced to the data rights assertions in Attachment Number (6) of this contract.

Task 1.4.3 TLCM Technical and Programmatic Risk Management

The consolidated, Government-led, SEIT IPT shall establish and maintain a government led LWSD Risk and Opportunity Management Board (ROMB) to identify technical and programmatic risks, identify potential cost and schedule improvement opportunities, and implement a well-planned risk and opportunity management process throughout the program. The Contractor shall document the risks in the Risk Management and Mitigation Plan (RMMP) and submit these as part of the LWSD RMMP. The Contractor shall attend and participate in the LWSD ROMB, establish and maintain a separate, contractor led TLCM ROMB, and record, produce/upload and/or deliver TLCM ROMB minutes. The Contractor shall provide specialty engineering required to validate TLCM design and compatibility of the associated LWSD subsystems with each other and with the land and ship based interfaces consistent with demonstration on the SDTS and support Government led analysis of any future, potential Government led installation on DDG-51 Flt IIA. Specialty engineering includes Electromagnetic Interference/Electromagnetic Compatibility (EMI/EMC), Mechanical Design Integration (MDI), Electrical Design Integration (EDI), Reliability and Maintainability.

Task 1.5 – System Safety. The Contractor shall have a System Safety lead that will function as the main Point of Contact for the Government Principal for Safety (PFS). The Contractor shall

provide adequate resources to participate in the System Safety Working Group (SSWG) Team to implement and monitor system safety requirements. The Contractor shall perform safety analyses as required to identify, assess, and mitigate hazards as the LWSD design matures in compliance with 'MIL-STD-882E' and 'OPNAVINST 5100.27B'. The Contractor shall develop a System Safety Program Plan (SSPP) that will provide details of the analyses to be conducted. This will include a Preliminary Hazard Analysis (PHA), System Requirements Hazard Analysis (SRHA), Sub-system Hazard Analysis (SSHA), Functional Hazard Analysis (FHA), and System Hazard Analysis (SHA). The Contractor shall conduct a Bent Pin Analysis (BPA) for any connectors carrying safety critical circuits. The Contractor shall perform software safety analyses to reduce contribution of software to mishap risk. The Contractor shall deliver updates of the Hazard Tracking System (HTS). The Contractor shall provide technical support for any analyses and materials required for Government safety review board reviews e.g. LSRB, Systems Software Safety Technical Review Panel (SSSTRP) and WSESRB.

The SSWG will be utilized to define and disseminate safety requirements to the Contractor who shall flow down these safety requirements to affected subsystems. For safety critical command and control functions, the SSWG shall define safety requirements such that at least three independent failures, or three human errors, or a combination of three independent failures and human errors must occur before a safety hazard becomes a mishap.

The Contractor shall develop and deliver safety-critical software which shall include only required and intended functionality and shall be resistant to accidental modification. The TLCM shall purge tactical, training, and testing data when transitioning between tactical, training, and testing modes. The Contractor shall perform software development in accordance with reference 1, ASN (RDA), 'Guidebook for Acquisition of Naval Software Intensive Systems', Version 1.0 Sept 2008, and reference 2, 'ISO/IEC 12207-2008 - Systems and Software Engineering - Software Life Cycle Processes', 2nd Edition 2008-02-01 in order to support collaborative development of software products with the government team. For additional details on government access and testing of software for safety purposes, see Section 2.5

Task 1.6 – System Requirements Review (SRR). The consolidated SEIT IPT shall conduct a SRR, consistent with criteria set out below. The Contractor shall develop and deliver TLCM Interface Control Documents (ICDs) and details of the TLCM conceptual design at the SRR consistent with Government established LWSD requirements.

SRR Exit Criteria:

- LWSD and TLCM requirements satisfy the LWSD system and TLCM capabilities as required by the SOW.
- LWSD and TLCM requirements are sufficiently detailed and understood to enable system functional definition, functional decomposition, test and evaluation (e.g. through DOORS).
- The requirements can be met given the technology maturation expected/achieved.
- External interfaces to the TLCM have been documented in Interface Control Documents.
- Adequate processes and metrics are in place for the program to succeed.
- Human Systems Integration and sustainment requirements have been reviewed and included in the overall system design.

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- The risks are known and manageable for development in accordance with the Risk Management Plan.
 - The program schedule is executable (technical and/or cost risks).
 - The program is properly staffed.
 - The program is executable within the existing budget.
 - Software and firmware functionality in TLCM specification is consistent with the software sizing estimates and the resource-loaded schedule.
 - Programming languages and architectures, security requirements and operational and support concepts have been identified. A Software Development Plan, Configuration Management Plan, and Software Build Plan are expected to be provided and reviewed at SRR.
 - Hazards have been reviewed and mitigating courses of action have been allocated within the overall system design.

Due to the requirement for software development under the TLCM tasks, all software is required to be reviewed by the Government at the source code level (e.g. for safety compliance prior to field testing on a Government range) and collocated with any tools used to complete compilation into objective subroutine codes or executable codes. For additional details on government access and testing of software, see Section 2.5. While delivery of proprietary source code or proprietary compilation tools for any software or firmware is not specifically required, a commensurate capability to ensure that configuration control is maintained as Computer Software Configuration Items (CSCIs), Computer Software Components (CSCs), and Computer Software Units (CSUs) shall be maintained at SRR. The Contractor shall include initial details (and update any previous details provided to the Government) at SRR of how access and configuration control shall be performed. Inability to provide sufficient access to source code software, per Section 2.5 of the SOW, shall be considered as a program documentation failure criterion by the Government at the time of the SRR.

Successful completion of the SRR shall be decided by the COR and shall establish approval and baseline of the TLCM conceptual design. SRR will be deemed complete upon conclusion of the SRR meeting, assignment of Pre-PDR action items and completion of SRR action items.

Task 1.7 – Beam Director Subsystem (BDS) Design. The Contractor shall complete the design of the BDS with off-axis telescope including the BDS Ball Assembly (BBA), BDS Gimbal Assembly (BGA), BDS Electronics Assembly (BEA), and BDS Subsystem Fabrication, Assembly and Test (FA&T) Planning consistent with proposed design (See Northrop Grumman Letter, Reference NG # SK-A23C-DAG-15-001 dated 27 JAN 2015 and Tab #1 Technical Approach and Justification, Sections 1.2.1.1.2 System Trades through 1.2.1.6 Structure and Support Subsystem (SSS), pages 6-33 including classified addendum) and LWSD CCB approved changes.

The Contractor shall include accommodation for three Mission Specific Modules (MSMs) in the BDS per the interface defined in ‘Solid State Laser Mission Specific Module Interface Functional Description’, version 1.1, 17 December 2014. The Contractor shall include an automated window cleaning capability in the BDS output window design. The Contractor shall define and execute risk reduction activities including the automated window cleaning capability

within the BDS. The Contractor shall address issues related to Electromagnetic Interference (EMI) protection in the windows, adjustable balance weights for MSMs, and required wiring, fiber and support lines (cooling, air) or harnesses. The Contractor shall support BDS design activity at all system level design reviews (SRR, PDR, CDR). In collaboration with the Government the Contractor shall develop and deliver FA&T plans for the BDS.

Task 1.8 – Targeting and Tracking Subsystem (TTS) Design. The Contractor shall complete the design of the TTS including the Beam Alignment and Stabilization Assembly (BASA), Fine Track Assembly (FTA), TTS Controller Assembly (TCA), Harness Assembly (THA) and Beam Transfer Assembly (BTA) consistent with proposed design and LWSD CCB approved changes. In collaboration with the Government the Contractor shall develop and deliver FA&T plans for the TTS. The Contractor shall define and execute risk reduction activities including robust image processing within the TTS. The Contractor shall support TTS design activity at all system level design reviews (SRR, PDR, CDR).

Task 1.9 – Fire Control Subsystem (FCS) & Software Design. The Contractor shall complete the design of the FCS including the Engagement Management Controller Assembly (EMCA). The Contractor shall provide design documentation for the Engagement Management Software (EMSW) in the Technical Data Package.

Due to the requirement for software development under the Fire Control Subsystem (FCS) & Software Design, all software developed under this task shall be coordinated and reviewed by the COR as necessary to perform safety and reliability analysis at the source code level. For additional details on government access and testing of software, see Section 2.5. While delivery of the source code for any proprietary software or proprietary firmware is not required, the ability to provide access to the software to conduct performance monitoring and safety monitoring is, and a commensurate capability to ensure that configuration control is maintained as Computer Software Configuration Items (CSCIs), Computer Software Components (CSCs), and Computer Software Units (CSUs) are. Included in this effort is the metric of Source lines of code (SLOC). The Contractor shall include details of SLOC as well as how access and configuration control on software and firmware shall be performed leading up to PDR and CDR, and provide specific updates on any software which has previously been identified as having less than unlimited rights and provide sufficient access for the Government to review source code at the Contractor's or Subcontractor's facility (as applicable) in order to conduct required assessments and reviews, as per Sec. 2.5.

The Contractor shall support the Government design and development of the interface between the TLCDM and the GFE Laser Weapon Console (LWC), consistent with 'Solid State Laser –Technology Maturation Advanced Demonstration Model Interface Functional Description For Solid State Laser – Laser Weapon Console', Version 1.1 November 2104, and FCS Overview of the Contractor proposal through routine interactions and data exchanges.

The Contractor shall design FCS interfaces to the LWC per 'Solid State Laser –Technology Maturation Advanced Demonstration Model Interface Functional Description for Solid State Laser – Laser Weapon Console', Version 1.1 November 2104, as well as the subsequent LWC Interface Requirements Specification (IRS) and Interface Data Description (IDD).

The Contractor shall design FCS interfaces to the GFE Hybrid Predictive Avoidance and Safety System (HPASS) unit as defined in 'Hybrid Predictive Avoidance and Safety System (HPASS) Increment 2.0 Interface Control Document, LDS-TM-HPASS-ICD-01004', Version

1.1, September 2014. The Contractor shall provide technical support for the development of safety cutouts to support land and sea based testing as defined by test locations and conditions.

The Contractor shall design FCS interfaces to the GFE Combat System per 'Solid State Laser – Technology Maturation Combat System Interface Requirements Specification', version 1.0, September 2014 and 'Solid State Laser – Technology Maturation Advanced Demonstration Model Combat System Interface Functional Description', version 2.0, September 2014.

The Contractor shall design FCS interfaces to the Mission Specific Module logical Coordinator per 'Solid State Laser Mission Specific Module Interface Functional Description', version 1.1, 17 December 2014.

The Contractor shall design the FCS interfaces to the control systems of the Power and Cooling systems per 'Solid State Laser Conceptual Cooling Skid Design, White Paper', 10 Jan 2014 and 'Interface Control Document SSL-TM Power System for Self-Defense Test Ship (SDTS) Demonstration, DRAFT', 14 May 2014.

The Contractor shall provide FA&T plans for the FCS. The Contractor shall support FCS design activity at all system level design reviews (SRR, PDR, CDR).

Task 1.10 – LWSD Cybersecurity. The Contractor shall attend and participate in the consolidated, Government-led SEIT IPT efforts to establish and implement a preliminary LWSD Cybersecurity Plan consistent with 'Information Assurance Policy Update for Platform Information Technology, DON CIO Memorandum 02-10', 26 Apr 2010, to include a roadmap to obtaining Cybersecurity accreditation required to conduct testing. The Contractor shall provide technical details and technical support for SEIT IPT efforts to develop draft cybersecurity technical plans and address technical implementation that will satisfy cybersecurity requirements for TLCM. For additional details on government access and testing of software for CyberSecurity/IA, see Section 2.5

Task 1.11 – Laser Subsystem (LS) Design. The Contractor shall complete the design of a 150 kW LS consistent with proposed overall system Power in Bucket Curves, and is expected to perform at least to the proposed values identified in Northrop Grumman Letter, Reference NG # SK-A23C-DAG-15-001 dated 27 JAN 2015 and Tab #1 Technical Approach and Justification, Section 1.2.1.1.3.4 PIB Curves and Key System Parameters, pages 10-11 including classified addendum.

The LS shall include the Laser Module Assembly (LMA), Laser Beam Combiner Assembly (LBCA), Laser Controller & Power Assembly (LPCA), and Hard Wired Abort System (HWAS). The Contractor shall design the LBCA to accept sufficient LMAs to achieve 150 kW laser output power.

The contractor shall provide for a laser source alignment system to be used prior to the Laser Subsystem (LS) high power laser "turn on" to establish that any laser device used in the LS is aligned to the Beam Control Subsystem (BCS). This would include a lower power laser surrogate in the form factor of an LRU, used to ensure adequate light path tracing and bore-sighting.

In collaboration with the Government, the Contractor shall develop and deliver FA&T plans for the LS using measurements in accordance with 'HEL JTO A Beam Quality Metric for High Energy Lasers', 30 July 2014. The Contractor shall define and execute risk reduction activities including spectral combination gratings, fiber amplifiers, and other critical components in the

LS. The Contractor shall support LS design activity at all system level design reviews (SRR, PDR, CDR).

Task 1.12 – Structure and Support Subsystem (SSS) Design. The Contractor shall complete the design of the SSS to include the Integrating Structure Assembly (ISA), the Beam Path Conditioning sub-assembly, and Heating Ventilation and Air Conditioning sub-assembly.

The Contractor shall provide all cooling fluid supply manifolds within the TLCM to distribute cooling water from the PCS Thermal Storage Skid (TSS) as defined in ‘Solid State Laser Conceptual Cooling Skid Design, White Paper’, 10 Jan 2014 to LWSD subsystems requiring cooling.

The Contractor shall provide all necessary cables with the TLCM required to distribute power from the PCS Energy Storage Module (ESM) as defined in ‘Interface Control Document SSL-TM Power System for Self-Defense Test Ship (SDTS) Demonstration, DRAFT’, 14 May 2014 to all TLCM subsystems. In collaboration with the Government, the Contractor shall develop and deliver FA&T plans for the SSS. The Contractor shall support SSS design activity at all system level design reviews (SRR, PDR, CDR).

Task 1.13 – TLCM Integration and Test. In collaboration with the COR, the Contractor shall develop and deliver an initial TLCM Integration and Test (I&T) plan by PDR. The Contractor shall develop and deliver planning documents that define the approaches and requirements to execute the I&T of the LWSD at CDR. The Contractor shall identify, acquire, design, and provide any TLCM Special Test Equipment (STE) or Ground Support Equipment (GSE) that is required to complete the TLCM and system level LWSD integration and test.

The Contractor, as a member of the consolidated SEIT IPT, shall support development of each of these plans and provide TLCM subsystem specific information to the consolidated SEIT IPT as required.

Task 1.14 – LWSD Test and Evaluation. The consolidated, Government-led T&E IPT shall provide an initial system Test and Evaluation (T&E) plan by the PDR. The consolidated SEIT IPT shall complete the LWSD system T&E plan and present the detailed plan at CDR, as well as initial plans for the specified land and sea testing of the LWSD system. These plans will be consistent with the Government Master Test and Evaluation Plan (MTEP).

The consolidated Government led SEIT IPT shall identify, acquire, design, and provide any LWSD Special Test Equipment (STE) or Ground Support Equipment (GSE) that is required to complete the LWSD Test and Evaluation.

The Contractor, as a member of the consolidated Government led T&E IPT shall support development and testing included in each of these plans and provide TLCM specific information to the consolidated Government led T&E IPT. The consolidated Government led T&E IPT shall include safety considerations in the master test plan to characterize safety critical components as needed. This will include testing of Non-Developmental Items (NDI) where source code or schematics are not available thereby preventing detailed safety analysis to be conducted. For additional details on government access and testing of software, see Section 2.5. In such cases, testing must be sufficient to identify reliability and safety of the device or subsystem especially in adverse circumstances (e.g. bad input causing catastrophic failures of device).

The Contractor shall begin developing an Operations and Maintenance Manual for the LWSD, in the form of an outline that identifies goals and maintenance strategy.

Task 1.15 – Preliminary Design Review (PDR). The consolidated LWSD IPT shall conduct a LWSD PDR consistent with criteria set out below. The Contractor shall include the preliminary design of the TLCM and its five subsystems at the PDR.

PDR Exit Criteria:

- Hardware:
 - The Preliminary design (hardware and software), including interface descriptions, is complete and satisfies all requirements in the LWSD system functional baseline (e.g. through DOORS).
 - The LWSD system and TLCM allocated baseline has been updated and documented to enable detailed design to proceed with proper configuration management.
 - Adequate processes and metrics are in place for the program to succeed.
 - Sustainment and human integration design factors have been reviewed and included, where needed, in the overall system design.
 - Risks are known and manageable for integrated testing and developmental and operational evaluation.
 - The program schedule is executable (technical/cost risks).
 - The program is properly staffed.
 - The program cost estimate has been updated.
 - The program is executable within the existing budget and with the approved system allocated baseline.
 - The preliminary system level design is producible within the production budget.
 - Producibility assessments of key technologies have been completed.
 - Long-lead and key supply chain elements have been identified.
 - Risks associated with hazards can be mitigated to an acceptable risk level within the existing budget.
- Software and Firmware:
 - The computer system and software architecture design have been established, and all Computer Software Configuration Items (CSCIs), Computer Software Components (CSCs), and Computer Software Units (CSUs) have been defined.
 - Software Requirements Specifications and Interface Requirement Specifications, including verification plans, are complete and baselined for all CSCs and they satisfy the LWSD system/subsystem functional requirements (e.g. through DOORS).
 - The Interface Control Documents trace all software interface requirements to the CSCIs and CSUs.
 - The computer system and software design/development approach have been confirmed through analyses, demonstrations, and prototyping in a relevant environment.

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- The preliminary software design has been defined and documented.
 - Software increments have been defined and capabilities have been allocated to specific increments.
 - Software trade studies addressing Commercial-off-the-shelf, reuse, and other software-related issues have been completed.
 - The software development process has been defined in a baselined Software Development Plan that is reflected in the Integrated Master Schedule (IMS).
 - The software development schedules reflect Contractor software processes and IMS software events for current and future development phases.
 - The software development environment and test/integration labs have been established with sufficient fidelity and capacity.
 - Unique software risks have been identified/assessed and mitigation plans have been developed/implemented.
 - Software metrics have been defined and reporting process implemented, and are being actively tracked and assessed.
 - Firmware Requirements Specifications and Interface Requirement Specifications, including verification plans, are complete and include all hardware components have been identified, with associated hardware description language (HDL) (e.g. VHDL/Verilog) development, unique chip-sets with algorithms, and associated design documentation.
 - Cyber security requirements (e.g., Interim Authority to Test (IATT), Interim Authority to Operate (IATO), or Authority to Operate (ATO)) have been addressed.
 - The Master Test Plan address all CSCI plans, test facilities, and test plans, including testing required to support incremental approaches (e.g. regression tests).
 - The software development estimates (i.e. size, effort (cost), and schedule) have been updated.
 - All required software-related documents have been baselined/delivered.

Successful completion of a PDR shall be decided by the Government and shall establish approval and baseline of the preliminary design of the reviewed TLM. PDR will be deemed complete upon conclusion of PDR meeting, completion of PDR action items, and assignment of Pre-CDR action items.

Task 1.16 – Critical Design Review (CDR). The consolidated, Government-led LWSD IPT shall conduct a LWSD CDR consistent with criteria set out below. The Contractor shall include the detailed design of the TLM, its five (5) subsystems and associated components at the CDR.

The CDR data package shall include either the Hardware or Software review items below depending on the item under review. The item shall be formally approved by the Navy before proceeding to fabrication.

Hardware Items:

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- Design specifications complete to substantiate the requirements of the configuration items and interfaces.
 - Supporting documents (trade studies, analysis, and test results) sufficient to substantiate detailed design.
 - Detailed configuration item design packages to the component level that include engineering drawings, block diagrams, process data, and logic diagrams (as applicable).
 - Interface control drawings.
 - Design approach and required access points to perform planned maintenance & transportation.
 - Compliance with appropriate safety requirements
 - Review any fabrication/production issues and action plans for closure
 - Review all test documentation for currency and adequacy.
 - Review design to ensure configuration items are adequately protected from applicable environments when integrated into the LWSD system.
 - Master Test Plan.
 - Configuration Management Plan.
 - Plans and status of parts procurement for long lead items.
 - Design analysis and test data available to substantiate design.
 - Review status of manufacturing engineering efforts, tooling, test equipment, new materials proofing, methods, processes and any special tooling and/or test equipment.

Computer Software Configuration Item (CSCI) Items:

- Software detailed design, and interface design complete and documented.
- Software Design Document (SDD) that details the full design of the software and the internal interfaces. The SDD describes the structure and detailed design of the units, components and assemblies of the entire LWSD system.
- Software Coding Standard that contains the rules, practices and conventions to be used in coding the software. This includes naming conventions, header format, code format, in-code documentation requirements, and a history of code changes with date and authorization.
- Software Test Procedures that document that the requirements are testable and the plan for software testing at each level of the software architecture.
- Requirements traceability matrix showing all requirements are accounted for in the design and will be tested.
- Supporting documentation (trade studies, analysis, and test results) sufficient to substantiate detailed design.
- Unit and Lower Level Software Units designs satisfy and traceable to CSCI requirements.

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- Information flow established between software units; Units sequencing and control methods defined.
 - Firmware Specifications are complete and include all hardware components have been identified, with associated development, unique chip-sets with algorithms, and associated design documentation for the entire TLCM system. Detailed interfaces include data source, destination, interface name and interrelationships.
 - Software Test Descriptions consistent with Software Development Plan.
 - Software Development Plan updated per PDR guidance.

CDR Exit Criteria:

- The LWSD baseline documentation is sufficiently complete and correct to enable hardware fabrication and software coding to proceed with proper configuration management.
- The Detailed design (hardware and software), including interface descriptions, is complete and satisfies all requirements in the LWSD system baseline documentation (e.g. through DOORS analysis or traceability).
- The verification (developmental test and evaluation) assessment to date is consistent with the TLCM system baseline and indicates the potential for test and evaluation success.
- Adequate processes and metrics are in place for the program to succeed.
- Risks are known and manageable for the demonstration program, and documented in the Risk Mitigation Plan.
- The LWSD and TLCM system Failure Mode, Effects, and Criticality Analysis (FMECA) is complete
- The program schedule is executable (technical/cost risks)
- The program is properly staffed
- The program is executable within the existing budget and the approved product baseline.
- All Critical Safety Items are identified and addressed
- Cyber security requirements (e.g., IATT, IATO, or ATO) have been addressed
- The software functionality in the approved product baseline is consistent with the updated software metrics and resource-loaded schedule.
- Key product characteristics having the most impact on system performance, assembly, cost, reliability, or safety have been identified.
- The overall design is at least 85% complete.

Successful completion of CDR shall be decided by the COR and shall establish approval and baseline of the detailed design of the reviewed System, subsystem, or component. CDR will be deemed complete upon conclusion of CDR meeting, completion of CDR action items, and assignment of pre-TRR action items.

2.2 OPTION I: PHASE II – LWSD FABRICATION, LAND BASED TESTING, AND DEMONSTRATOR DELIVERY

Phase II consists of the TLCM Fabrication, Assembly, and Test (FA&T), Program Management, System Engineering Integration and Test (SEIT), LWSD Integration and Test (I&T), and Land Based Test and Evaluation (T&E) activities. The TLCM FA&T is composed of five subtasks that include one element for each of the TLCM subsystems. Program Management and SEIT tasks include four level 4 WBS element subtasks plus additional tasks to cover safety and security. This phase ends with the Test Readiness Review (TRR) and LWSD delivery.

Task 2.1 – Program Management. The Contractor shall perform program management including conducting quarterly program reviews and monthly technical and financial status reports. Quarterly program reviews will include updates to the IMS, Technical Data Package (TDP), review presentation materials, and any adjustments to anticipated technical activities for Phase III with associated budgetary adjustments to cost and schedule estimates, to be further defined and addressed via engineering change proposal at the start of Phase III.

Technical Exchange Meetings (TEMs) and Functional Area Working Group Meetings shall be conducted as required by program tempo and as determined by risk assessment and program concerns. These additional meetings will be conducted via teleconference or at a facility required to facilitate discussion and review of design documentation or hardware activities. The Contractor shall perform program management functions necessary to ensure program health, objectives, risks, and tasks are executed on schedule and within budget.

The Contractor shall perform program management functions necessary to ensure program health, objectives, risks, and tasks are executed on-schedule and within budget. The Contractor shall provide contractual communications with the Government. The Contractor shall provide the contractual communication and management of subcontractors. The Contractor shall provide business management including financial control and reporting.

The Contractor shall attend and participate in the Government led LWSD Configuration Control Board (CCB) to maintain and control the TLCM and LWSD configuration including review of changes affecting form, fit, or function of any subsystem or ICD and elevation to an ECP, as necessary. The Contractor shall maintain and chair the TLCM CCB to maintain and control the TLCM configuration including review of changes internal to the TLCM affecting form, fit, or function of any subsystem or ICD, and elevation to the LWSD CCB.

The Government and Contractor shall maintain the LWSD level Material Review Boards (MRB) and Failure Review Boards (FRB), as determined necessary by the Government, to investigate failures during Fabrication, Assembly, and Test (FA&T), Integration and Test (I&T) or Test and Evaluation (T&E) activities. The Contractor shall utilize government or government agreed to commercial standard MRB and FRB processes to collect, analyze, and record all failures that occur to the TLCM system, subsystems and components being developed, integrated, and tested. The MRB shall review discrepancies that arise during subsystem FA&T while the FRB shall review failures that occur after subsystem delivery for system I&T or T&E. COR concurrence with all MRB and FRB findings via a Government representative seated on each board shall be required. The Contractor shall deliver minutes from these board meetings to the Government.

The Contractor shall provide visibility and access to all available software products as required for safety review regardless of data rights or ultimate ownership

Task 2.2 – Visits and Access. The Contractor shall provide the COR and Government representatives with reasonable facilities and equipment, and access to all areas essential to the proper conduct of reviews, IPT meetings Technical Exchange Meetings (TEMs) and Functional Area Working Group Meetings. U.S. Government representatives will meet the Contractor's security and export control requirements.

Task 2.3 – Security. The Contractor shall provide technical and management support for the implementation, and adherence to security policies and procedures based on the DD Form 254, Security Classification Specification and associated Security Classification Guidance.

Task 2.4 – System Engineering. The Contractor shall track top level Technical Performance Metrics (TPMs) established in Phase I and report TPM status at quarterly program reviews and Technical Data Package updates. Beam quality metrics shall be measured in accordance with 'HEL JTO A Beam Quality Metric for High Energy Lasers', 30 July 2014, and shall be tracked as a Technical Performance Metric (TPM) and measured against the provided power curves included with the proposed design as detailed in Northrop Grumman Letter, Reference NG # SK-A23C-DAG-15-001 dated 27 JAN 2015 and Tab #1 Technical Approach and Justification, Section 1.2.1.1.3.4 PIB Curves and Key System Parameters, pages 10-11 including classified addendum).

The Contractor shall develop and deliver updated Interface Control Documentation. The Contractor shall track predicted subsystem performance against allocated requirements. The Contractor shall perform analysis and modeling activities sufficient to establish performance of the TLCM in the LWSD system as designed against the required missions and perform system trades. The Contractor shall share Modeling and Simulation (M&S) inputs and methodology with the Government M&S Subject Matter Expert(s).

The consolidated, Government-led, SEIT IPT shall maintain a LWSD Risk and Opportunity Management Board (ROMB) to identify technical and programmatic risks, identify potential cost and schedule improvement opportunities, and implement a well-planned risk and opportunity management process throughout the program. The Contractor shall attend and participate in the LWSD ROMB and maintain the TLCM ROMB, producing and delivering TLCM ROMB minutes.

The Contractor shall produce test reports summarizing the subsystem and system performance metrics and provide supporting analysis with processed data to demonstrate the TLCM system performance meets all associated SEIT requirements. For requirements traceability and verification status accounting, the Contractor shall maintain an up-to-date TLCM DOORS database (on a Navy file sharing site, or provide a capability such that the Government has sufficient access to an up-to-date version of the Contractor's DOORS database). Database attributes and traceability methods will be defined by the Government. For system architecture, the Contractor shall use the MagicDraw tool. This will include the software and physical decomposition of the TLCM. Interfaces with subsystems external to the TLCM shall be defined jointly with the Government and will be configuration controlled in the MagicDraw database.

The Contractor shall provide specialty engineering required for validating system design and compatibility of the subsystems with each other and with the land and ship based interfaces. Specialty engineering includes EMI/EMC, Mechanical Design Integration (MDI), Electrical Design Integration (EDI), Reliability and Maintainability consistent with demonstration on the SDTS and support Government led analysis of any future, potential Government led installation on DDG-51 Flt IIA.

Task 2.5 – System Safety. The Contractor shall have a System Safety lead that will function as the main Point of Contact for the Government Principal for Safety (PFS) and provide System Safety Program Status Reports on a quarterly basis. The Contractor shall provide adequate resources to participate in the System Safety Working Group (SSWG) Team to implement requirements for and monitor implementation of system safety requirements. The Contractor shall update the status of safety documentation and design maturity as required throughout the TLCM or associated LWSD system level FA&T. The Contractor shall complete software safety analyses to reduce contribution of software to mishap risk. The Contractor shall perform other hazard analysis to identify, assess, and mitigate mishap risk as needed.

The Contractor shall develop and deliver an Operating and Support Hazard Analysis (O&SHA), Health Hazard Analysis (HHA), and a Safety Assessment Report (SAR). The Contractor shall participate in the Government's SSWG and provide updates to the HTS as required. The Contractor shall review all Engineering Change Requests (ECRs) or LWSD design changes to assess safety impact and make recommendations as necessary.

The Contractor shall provide any analyses and materials required for Government safety review board reviews e.g. LSRB, SSSTRP and WSESRB. The Contractor shall provide all material necessary to comply with National Environmental Policy Act (NEPA) and all other environmental regulations that would apply to the LWSD.

Task 2.6 – Beam Director Subsystem (BDS) Fabrication, Assembly and Test. The Contractor shall fabricate, assemble, and test the BDS with off-axis telescope consistent with proposed design including any relevant Government Furnished Equipment (GFE) or subsystems as listed in Section 4 of this document. All connecting conduits, cabling (power, cooling and data) from the GFE to the BDS shall be provided by the contractor unless otherwise specified by the government.

The Contractor shall perform the assembly of the subsystem, integrate the electronics and software, and execute the FA&T plans developed in Phase I for the BDS. The Contractor shall generate the subsystem verification test procedures and provide engineering technical support to evaluate the subsystem test results to demonstrate that the subsystem meets all interface and system requirements. These plans and activities shall be managed through the consolidated Government led SEIT IPT.

Task 2.7 – Targeting and Tracking Subsystem (TTS) Fabrication, Assembly, and Test. The Contractor shall fabricate, assemble, and test the TTS consistent with proposed design including any Government Furnished Equipment (GFE) or subsystems as listed in Section 4 of this document. All connecting conduits, cabling (power, cooling and data) from the GFE to the TTS shall be provided by the contractor unless otherwise specified by the government.

The Contractor shall perform the assembly of the subsystem, integrate the electronics and software, and execute the FA&T plans developed in Phase I for the TTS. The Contractor shall generate the subsystem verification test procedures and provide engineering technical support to evaluate the subsystem test results to demonstrate that the subsystem meets all interface and system requirements. These plans and activities will be managed through the consolidated Government led SEIT IPT.

Task 2.8 –Fire Control Subsystem (FCS) Fabrication, Assembly, and Test. The Contractor shall fabricate, assemble, and test the FCS including any Government Furnished Equipment (GFE) or subsystems as listed in Section 4 of this document in coordination with the

consolidated build schedule of the LWC and Combat System Virtual Test Bed (VTB). All connecting conduits, cabling (power, cooling and data) from the GFE to the TTS shall be provided by the contractor unless otherwise specified by the government.

The Contractor shall perform the assembly of the subsystem, integrate the electronics and software, and execute the FA&T plans developed in Phase I for the FCS. The Contractor shall generate the subsystem verification test procedures and provide engineering technical support to evaluate the subsystem test results to demonstrate that the subsystem meets all interface and system requirements including HPASS Safety cutouts. These plans and activities will be managed through the consolidated Government led SEIT IPT.

Task 2.9 – LWSD Cybersecurity.

The Contractor shall attend and participate in the consolidated, Government-led, SEIT IPT efforts to deliver and implement a finalized LWSD Cybersecurity Plan consistent with ‘Information Assurance Policy Update for Platform Information Technology, DON CIO Memorandum 02-10’, 26 Apr 2010 to obtain cybersecurity accreditation required to conduct testing.

Task 2.10 –Laser Subsystem (LS) Fabrication, Assembly, and Test. The Contractor shall fabricate, assemble, and test the 150 kW LS consistent with proposed design including any Government Furnished Equipment (GFE) or subsystems as listed in Section 4.0 of this document. All connecting conduits, cabling (power, cooling and data) from the GFE to the LS shall be provided by the contractor, unless otherwise specified by the government.

The Contractor shall perform the assembly of the subsystem, integrate the electronics and software, and execute the FA&T plans developed in Phase I for the LS. The Contractor shall generate the subsystem verification test procedures and provide engineering technical support to evaluate the subsystem test results to demonstrate that the subsystem meets all interface and system requirements using measurements in accordance with ‘HEL JTO A Beam Quality Metric for High Energy Lasers’, 30 July 2014. These plans and activities will be managed through the consolidated Government led SEIT IPT.

Task 2.11 –Structure and Support Subsystem (SSS) Fabrication, Assembly, and Test. The Contractor shall fabricate, assemble, and test the SSS, consistent proposed design including any Government Furnished Equipment (GFE) or subsystems as listed in Section 4.0 of this document. All connecting conduits, cabling (power, cooling and data) from the GFE to the SSS shall be provided by the contractor unless otherwise specified by the government.

The Contractor shall perform the assembly of the subsystem, integrate the electronics and software, and execute the FA&T plans developed in Phase I for the SSS. The Contractor shall generate the subsystem verification test procedures and provide engineering technical support to evaluate the subsystem test results to demonstrate that the subsystem meets all interface and system requirements. These plans and activities will be managed through the consolidated Government led SEIT IPT.

Task 2.12 – TLCM Integration and Test. The Contractor shall attend and participate in the consolidated, Government-led System Engineering, Integration and Test (SEIT) IPT efforts to produce and implement required System Engineering, Integration and Test procedures for integrating the TLCM subsystems into a single LWSD - as well as Land Based Testing (LBT) and Sea Based Testing (SBT). All hardware, software, firmware, or consumables (e.g. spares, documentation and included connecting conduits, cabling required for power, cooling and data)

required to interface the GFE to the Contractor furnished or required equipment shall be provided by the Contractor in order to produce a fully functional system in both Land and Sea Based Tests (LBT/SBT) unless otherwise specified by the Government. The Contractor shall complete the design, acquisition, and fabrication of any required, TLCM specific - Special Test Equipment (STE), Ground Support Equipment (GSE) or Mechanical Ground Support Equipment (MGSE) - unless otherwise agreed to in writing and provided by the government.

It is noted that the Government will supply cabling (data and power) to and from the GFE Laser Weapon Console (LWC) to the Contractor supplied TLCM and its support structure, as required to enable a fully functional system in both the Land and Sea Based Tests (LBT/SBT), in accordance with the Interface Functional Configuration and Documentation (IFC/IFD) developed in the SSL program. Additionally, the Government will be responsible for any routing and installation of cabling between the TLCM and the LWC while the TLCM is on the Self Defense Test Ship.

Task 2.13 – System Test and Evaluation. The Contractor shall attend and participate in the consolidated, Government-led T&E IPT to produce LWSD Test and Evaluation (T&E) procedures and execute up to two Land Based Tests (LBTs) at a shore-based "open air" Government test range to be determined by the Government to demonstrate all system performance requirements have been achieved.

Task 2.14 – LWSD Test Readiness Review (TRR). The Contractor shall present the current design of the TLCM in the LWSD system and its subsystems for approval and baseline for testing at the Government led LWSD TRR. This review shall include any designs or required tasks for modification of the TLCM, LWSD or SDTS in order to enable integration of the LWSD onto the SDTS and conduct required testing. The Contractor shall provide technical support to the Government for resolution of any TRR action items related to the TLCM. The Contractor shall deliver a final version of the operating and maintenance manuals for the TLCM.

The Contractor shall support the Government Lead System Integrator to review and demonstrate completion of the entrance and exit criteria listed below for any TLCM related metrics, performance or interfaces.

Entrance Criteria

- Technical data package (TDP) complete and configuration management status
- Test plans mapped to program requirements in Requirements Verification Traceability Matrix (RVTM)
- Test Reports from previous testing (Land-Based Test 1 and Land-Based Test 2) complete and final submissions made
- Required system compliance efforts complete, including environmental, Information Assurance, Laser Clearing House, electromagnetic compatibility, and operational security

Successful completion of any required system safety analyses (Hazards of Electromagnetic Radiation to Ordnance (HERO), Hazardous Material (HAZMAT), LSRB, etc.), including required safety approvals in place for ship, range, and laser safety.

- Scenario certification complete (in both Test & Evaluation Strategy (T&ES) and MTEP)
- Test plan and test procedures approved by Range Safety Officer (RSO)

-
- Test team in place, and leads designated
 - Laser safety training complete
 - Ship riders completed Tier 1 shipboard work training
 - Test articles (targets) acquired
 - Required facilities secured
 - Instrumentation plan in place and instrumentation resources secured, including atmospheric and laser instruments
 - Communications and data systems identified
 - Support equipment identified and coordinated
 - Approval of Temporary Ship Alteration Record (TSAR) and Test Ship Installation Drawings (TSID) in place, and ship modifications completed
 - Cyber security requirements satisfied (e.g., IATT, IATO, or ATO)
 - Go-No/go criteria established (Weather, Fuel, Manning, Training, Supplies, etc.)
 - Interface testing completed with the combat system/range data system, HPASS, and LWC
 - Range ready to support testing
 - Modeling and simulation predictions complete
 - Hazards identified for utilization of any and all CSCI in Land Based testing and SDTS testing. Analyses showing that all hazards in the hardware and software of the CSCI with respect to its installation, operation, maintenance and de-installation during testing (land-based and on the SDTS) have been identified. This analysis should include mitigations for these hazards and risk assessment of the residual risk of these hazards for program acceptance.
 - Risk mitigation plans in place

Exit Criteria

- Required safety approvals are in place for the LWSD and TLCM
- Objective Qualifying Evidence (OQE) from Land Based Testing (LBT-1 and LBT-2) which provide suitable confidence that sea testing, including interfaces to combat system, HPASS and LWC is ready to commence as scheduled and planned
- Verified traceability of planned tests to program requirements and Key Performance Parameters (KPPs), including those for the TLCM
- Test procedures are consistent with Test Plans and schedules, including any alternate schedules for unforeseen, unexpected delays or weather delays.
- Target preparations complete
- Test team assessed as ready
- Electromagnetic compliance requirements satisfied
- Instrumentation ready, including atmospheric and laser

-
- LWSD must be ready for integration with the test platform, including ship electrical and cooling modifications
 - Range support activities ready
 - Voice and data communications plans in place
 - Needed certifications and/or waivers in place
 - Risk mitigation plans accepted
 - Plan for resolving outstanding issues in place

Successful completion of the TRR shall be decided by the Government and shall establish approval for Pier-side delivery. TRR will be deemed complete upon conclusion of the TRR meeting, completion of TRR action items, and assignment of pre-delivery action items.

Task 2.15 – TLCM Pier-side delivery. Upon successful approval of the TRR, the Contractor shall deliver the TLCM pier-side at the SDTS in the sea-based testing configuration, ready for SDTS integration. In addition, the Contractor shall deliver any required integration, interface, test, or diagnostic hardware.

2.3 OPTION II: PHASE III – LWSD INSTALLATION AND SEA BASED TESTING

Phase III consists of support from the Contractor for LWSD integration onto the SDTS and Sea Based Test (SBT).

Task 3.1 – Program Management. The Contractor shall perform program management functions necessary to ensure program health, objectives, risks, and tasks are executed on schedule and within budget. The Contractor shall provide contractual communications with the Government, including interactions with TLCM suppliers and subcontractors. The Contractor shall provide business management including monthly technical and financial reports. The Contractor shall attend and participate in the Government convened Failure Review Boards (FRB), as appropriate, to investigate failures during Sea Based Test activities. The COR or shall produce minutes from these board meetings and provide them as a deliverable to the Government.

Task 3.2 – Visits and Access. The Contractor shall provide the COR and the Government representatives with reasonable facilities and equipment, and access to all areas essential to the proper conduct of reviews. U.S. Government representatives will meet the Contractor's security and export control requirements.

Task 3.3 – Security. The Contractor shall provide technical and management support for the implementation, and adherence to security policies and procedures based on the DD

Form 254, Security Classification Specification and associated Security Classification Guidance.

Task 3.4 – System Engineering. The Contractor shall attend and participate in the consolidated, Government-led, SEIT IPT and Government T&E IPT efforts to produce test reports summarizing the LWSD system performance metrics based on analysis of processed data to demonstrate that the delivered system satisfies program requirements.

The consolidated, Government-led, SEIT IPT shall maintain a LWSD Risk and Opportunity Management Board (ROMB) to identify technical and programmatic risks, identify potential cost and schedule improvement opportunities, and implement a well-planned risk and opportunity management process throughout the program. The Contractor shall produce and deliver TLMC Risk and Opportunity Management Board minutes.

The Contractor shall provide a final report for the LWSD program. The Contractor shall deliver final TDP and "As Built" Engineering Drawings. As necessary, The Contractor shall deliver Interface Control Documents (ICDs), and update previously delivered Interface documentation on a quarterly basis.

Task 3.5 – System Safety. The Contractor shall provide a System Safety lead who will function as the main Point of Contact for the Government Principal for Safety (PFS) throughout the Phase III activity. The Contractor shall review all Engineering Change Requests (ECRs) or LWSD design changes to assess safety impact and make recommendations as necessary. The Contractor shall provide any analyses and materials required for Government safety review board reviews e.g. LSRB, SSSTRP and WSESRB.

Task 3.6 – LWSD Integration and Test. The Contractor shall provide technical, hardware, and software support to the Government during the LWSD installation onto the SDTS.

Task 3.7 – LWSD Test and Evaluation. The Contractor shall provide on-site technical, hardware, and software support to the Government in executing the LWSD Test and Evaluation procedures developed in Phase II for the Sea Based Test. Sea Based Test series shall consist of two at sea test periods of up to two-week duration. The first and second sea test periods shall be separated by approximately six weeks during which the LWSD and associated TLMC system will remain installed on the ship but not tested.

2.4 OPTION III: ADDITIONAL RESEARCH STUDIES, EVALUATIONS, ADDITIONAL SPARES AND ANALYSES

Task 4.1 – Research Studies, Evaluations, and Analyses. The Contractor, as requested by the PCO, shall propose additional research studies, evaluations, and analyses for consideration of a mutually acceptable change order. Upon agreement between the parties, Contractor shall conduct research and analysis to support integration of alternate missions, platforms, subsystems, sensors, software and components as an excursion to the system. This research and subsequent analyses may include integration of alternate platform or missions which would result in possible changes to the design configuration or analyses. This research may also include the assessment of new, innovative technologies to determine their potential usefulness and applicability to the laser system performance either as designed and built or with specified modifications, on new surface ship platforms, against emergent threats.

The Contractor, as requested by the Government, may also be asked to provide additional maintenance and installation labor of spares of the delivered system in order to keep the LWSD/TLMC system in an operable condition for additional testing and demonstration events. This task shall also include troubleshooting, repair and labor associated with the replacement of optical, electrical, and mechanical components along with modification of key interfaces as designated by and with coordination and approval by the ONR COR. The Contractor shall, as requested by the Government, collect, analyze, and report on failure and corrective actions taken along with component/material deficiency reports as a result of the additional maintenance or repair actions, as required.

Task 4.2 – Spares. The Contractor, as requested by the COR, shall provide a set of additional spare materials in support of the program within one (1) year of delivery of the TLCM to the Government. These materials may include subcomponents such as additional laser line replaceable units (LRUs), critical optical assemblies, replacement power supplies, mechanical components, structural components, and other hardware or electronics necessary to continue functional or safety.

The requested materials identified are exclusive of processing labor that may convert raw materials into finished goods ready for use in the TLCM, such as for turning pattern blanks or unfinished spares into finished products.

2.5 TLCM SOFTWARE ACCESS AND GOVERNMENT DIRECTED SOFTWARE DEVELOPMENT ANALYSES

All executable or compiled code delivered as part of the TLCM or associated LWSD shall be free of any code or technical measure that might in any way interfere with the government's ability to perpetually use, and exercise its license rights in, software delivered under the contract; the executable and compiled code delivered, must be a result of the source code reviews conducted, and remain otherwise, unmodified. Commercially available code which is not required to operate the TLCM or associated LWSD, is not required as source code, but shall be specified with version and status within any associated technical data package or major review (e.g. SFR/SRR, PDR, CDR, and TRR) and delivered to the Government unless otherwise stipulated or negotiated by the government, in writing.

Where limited and/or restricted data rights (as applicable) are asserted for, and restrict the government's rights in, any software products used on the TLCM or LWSD, the Contractor shall provide, and ensure that its Subcontractors provides, the Government access to any software, including source code, to be included a part of a TLCM or LWSD associated deliverable. The Contractor shall follow the below process in order to provide access

:

- a) Stipulate the locations of where the software, including non-commercial or development source code, resides in source code form, at the time of the Contractor Kick Off Meeting, (thereby enabling the government to begin planning for required software tests and reviews),
- b) Ensure that it and its Subcontractor provides for Government representatives the ability to access the facility identified in (a) above with access to the relevant, associated source code,
- c) Provide for the ability to execute (or have the subcontractor execute), under the government representative's direction, a government provided software analysis package, consisting of software safety/reliability and/or Cyber/IA scanning on the source code, compiled code, or executable code, hardware of the TLCM, or any computational system used in TLCM software development,
- d) Provide the government representative ability to review the results of the government provided software analysis package as the analysis is being conducted, and
- e) Provide a copy of the resulting files generated by the government provided software analysis package, though electronic data media (CDROM, DVD, e-file

transfer) or printed forms.

The Contractor shall provide the Government the ability to direct, witness and review the running of testing - including the running of safety tests, cyber security scans and reliability tests,- on the source code software, the development platforms and any associated TLCM hardware – at the Contractor’s facility or the Subcontractor’s facility (as applicable) is an important requirement that cannot be dismissed without government written concurrence. These required government tests shall include but are not limited to government provided software suites (often via CDROM or DVD as executable files), which then shall be provided to and executed by Contractor or Subcontractor personnel (as applicable) under the direction and direct supervision of the Government, typically with a government representative physically being present for the duration of the testing. Resulting data collected from the government provided software analysis package shall be provided, unmodified, by the contractor or subcontractor’s computer operator to the overseeing government official. The method of transfer of the government provided software analysis package results shall be as directed by the overseeing government official, in order to ensure document accuracy, and may be (by way of mutual agreement, as documented by the Contracting Officer Representative or COR) in electronic (e-File), electronic media (CDROM or DVD), or printed forms.

The safe operation and reliability of the TLCM and LWSD on Government owned and operated test ranges is the objective of the government provided software analysis package. Unless otherwise specified and previously stipulated by the government, the government safety and Cyber/IA scanning software suites shall support the basic operating system used in the TLCM, and shall be exercised on any portion of the TLCM system or subsystem’s source code, compiled code, executable code or provided commercially available software. Each test on the TLCM system or subsystem’s source code or software shall be run at the contractor or subcontractor facility site, unless otherwise specified and previously stipulated by the government.

The intent is to provide the government the ability to fully assess safety, potential liability, and the ability to meet both Cybersecurity and Information Assurance (IA) requirements necessary to support tests of the TLCM and the resulting LWSD on Government ranges.

3.0 DELIVERABLES

3.1 PROGRAM DELIVERABLES

The table below identifies deliverables that will be provided as part of the LWSD program. Items identified with an A (i.e. A001 – A022) are Exhibit A, Category-Engineering; items identified with a B (i.e. B001 – B008) are Exhibit B, Category-Administrative/Management; items identified with a C (i.e. C001 – C003) are Exhibit C, Category-TDP; items identified with a D (i.e. D001) are Exhibit D, Category-Financial; items identified with an E (i.e. E001) are Exhibit E, Category TM.

This list is provided here for reference only. CDRL requirements, including descriptions, are provided at Exhibit A.

CDRL NUMBER	TITLE OF CONTRACT DATA REQUIREMENTS LIST (CDRL)	APPLICABLE CONTRACT LINE ITEM (CLIN)	FREQUENCY
A001	Presentation Material - LWSD Systems Requirement Review (SRR) Briefing Charts and Technical Summary Report	Base/CLIN 0001	ONE/R
A002	Presentation Material - LWSD Preliminary Design Review (PDR) Briefing Charts and Technical Summary Report	Base/CLIN 0001	ONE/R
A003	Presentation Material - LWSD Critical Design Review (CDR) Briefing Charts and Technical Summary Report	Base/CLIN 0001	ONE/R
A004	Department of Defense Standard Practice: System Safety - Preliminary Hazard Analysis (PHA) Documentation for Tactical Laser Core Module (TLCM)	Base/CLIN 0001	ONE/R
A005	Department of Defense Standard Practice: System Safety - Functional Hazard Analysis (FHA) Documentation for Tactical Laser Core Module (TLCM)	Base/CLIN 0001	ONE/R
A006	Department of Defense Standard Practice: System Safety - LWSD System Requirements Hazard Analysis (SRHA)	Base/CLIN 0001	ONE/R
A007	Department of Defense Standard Practice: System Safety - LWSD System Hazard Analysis (SHA)	Base/CLIN 0001	ONE/R
A008	Department of Defense Standard Practice: System Safety - LWSD Sub-System Hazard Analysis (SSHA)	Base/CLIN 0001	ONE/R
A009	Parts List - Tactical Laser Core Module (TLCM) Critical Long Lead Item (CLLI) List	Base/CLIN 0001	ASREQ
A010	System Safety Program Plan (SSPP) - System Safety Program Plan (SSPP) for Tactical Laser Core Module (TLCM)	Base/CLIN 0001	ONE/R
A011	Department of Defense Standard Practice: System Safety - LWSD Health Hazard Analysis (HHA)	Option I/CLIN 0003	ONE/R
A012	Department of Defense Standard Practice: System Safety -	Option I/CLIN 0003	ONE/R

	LWSD Operating and Support Hazard Analysis (O&SHA)		
A013	Department of Defense Standard Practice: System Safety - LWSD Safety Assessment Report (SAR)	Option I/CLIN 0003	See Block 16
A014	Department of Defense Standard Practice: System Safety - LWSD System Safety Program Status Report	Option I/CLIN 0003	QRTLY
A015	Status Report - Solid State, High Power Laser Weapon System Demonstrator (LWSD) Final Report	Option II/CLIN 0005	ONE/R
A016	Test/Inspection Report - LWSD Test Reports	Base/CLIN 0001, Option I/CLIN 0003, Option II/CLIN 0005	ASREQ
A017	Interface Control Document - LWSD Interface Control Documents (ICD)	Base/CLIN 0001, Option I/CLIN 0003, Option II/CLIN 0005	See Block 16
A018	Integrated Master Schedule (IMS) - LWSD Integrated Master Schedule (IMS)	Base/CLIN 0001, Option I/CLIN 0003, Option II/CLIN 0005	QRTLY
A019	Systems Engineering Plan (SEP) - Tactical Laser Core Module (TLCM) Systems Engineering Plan (SEP)	Base/CLIN 0001, Option I/CLIN 0003	QRTLY
A020	Technical Report-Study / Services - LWSD DOORS database update	Base/CLIN 0001, Option I/CLIN 0003, Option II/CLIN 0005	ASREQ
A021	Technical Data Package (TDP)- LWSD Hazard Tracking System (HTS)	Base/CLIN 0001, Option I/CLIN 0003	QRTLY
A022	Contractor's Risk Management Plan - Tactical Laser Core Module (TLCM) Risk Management and Mitigation Plan (RMMP)	Base/CLIN 0001, Option I/CLIN 0003, Option II/CLIN 0005	QRTLY
B001	Conference Minutes - Tactical Laser Core Module (TLCM) Risk and Opportunity Management Board (ROMB) Meeting Minutes	Base/CLIN 0001, Option I/CLIN 0003, Option II/CLIN 0005	ASREQ
B002	Conference Minutes - Tactical Laser Core Module (TLCM) Configuration Control Board (CCB) Meeting Minutes	Base/CLIN 0001, Option I/CLIN 0003, Option II/CLIN 0005	ASREQ
B003	Conference Minutes - Tactical Laser Core Module (TLCM) Material Review Board (MRB) Meeting Minutes	Base/CLIN 0001, Option I/CLIN 0003, Option II/CLIN 0005	ASREQ
B004	Conference Minutes - Tactical Laser Core Module (TLCM) Failure Review Board (FRB) Meeting Minutes	Base/CLIN 0001, Option I/CLIN 0003, Option II/CLIN 0005	ASREQ
B005	Contractor's Progress Status and	Base/CLIN 0001,	MTHLY

	Management Report - LWSD Technical and Financial Progress Reports	Option I/CLIN 0003, Option II/CLIN 0005	
B006	Contractor Roster - LWSD Integrated Product Team (IPT) Team Member List	Base/CLIN 0001, Option I/CLIN 0003, Option II/CLIN 0005	ASREQ
B007	Conference Minutes - LWSD Technical Exchange Meetings (TEM) and Functional Area Working Group (WG) Meeting Minutes	Base/CLIN 0001, Option I/CLIN 0003, Option II/CLIN 0005	ASREQ
B008	Presentation Material - LWSD Quarterly Review Briefing Charts	Base/CLIN 0001, Option I/CLIN 0003, Option II/CLIN 0005	QRTLY
C001	Technical Data Packages, Engineering Drawing Practices - LWSD "As-Built" Engineering Drawings	Base/CLIN 0001, Option I/CLIN 0003, Option II/CLIN 0005	1TIME
C002	Technical Data Package (TDP) - LWSD Test Readiness Review (TRR) Technical Data Package (TDP)	Option I/CLIN 0003	ONE/R
C003	Technical Data Packages (TDP), Software Requirements Specification (SRS) - LWSD Technical Data Package (TDP)	Base/CLIN 0001, Option I/CLIN 0003, Option II/CLIN 0005	QRTLY
D001	Contract Work Breakdown Structure - LWSD Contract Work Breakdown Structure (CWBS)	Base/CLIN 0001, Option I/CLIN 0003, Option II/CLIN 0005	ASREQ
E001	Manuals Technical Style and Format Requirements, Technical Manual Preparation - LWSD Operation and Maintenance Manuals	Base/CLIN 0001, Option I/CLIN 0003, Option II/CLIN 0005	ASREQ

4.0 GOVERNMENT RESPONSIBILITIES

4.1 GOVERNMENT FURNISHED FACILITIES (GFF)

The Government shall make available to the Contractor the following facilities as outlined in the schedule below for use during the performance of this contract, as deemed appropriate and required by the Contracting Officer Representative (COR). Government furnished facilities (GFF) shall be utilized in an "As Is", "As Available" state, and only as necessary to support mission and contract requirements within the Estimated Usage Dates (or events) as listed. Updated schedules of use may occur as the contract executes, and shall be shared through means of electronic distribution of the Integrated Work Schedule (IWS). Any associated visitation to, or use of the Government furnished facilities (GFF) outside of those identified in the IWS shall be scheduled with the facility POC and concurred with the Contracting Officer Representative (COR) no less than 10 days in advance. Any modification to the GFF shall not be permitted without the government's concurrence.

Description of Gov't Facilities	Facility PoC:	Facility PoC E-mail:	Facility PoC Phone #:	Est. Usage Dates:
Port Hueneme shore-based "open air" government test range	Terry Robinson Directed Energy Project Manager Office of Engineering and Technology NAVSEA Port Hueneme Code 202	terry.robinson@navy.mil	Office: 805-228-7917 Cell: 805-340-5944	LBT1 & LBT2
Self Defense Test Ship (SDTS) Accommodations – 8 NGAS support crew	Terry Robinson Directed Energy Project Manager Office of Engineering and Technology NAVSEA Port Hueneme Code 202	terry.robinson@navy.mil	Office: 805-228-7917 Cell: 805-340-5944	SBT1 & SBT2

4.2 GOVERNMENT FURNISHED EQUIPMENT (GFE)

The Government shall make available to the Contractor the following equipment as outlined in the schedule below for use during the performance of this contract. Modifications to the Government Furnished Equipment (GFE) shall not be permitted. The government plans to update and share the updated equipment via mutually agreed to schedules as identified in the Laser Weapon System Demonstrator (LWSD) Integrated Work Schedule (IWS). The LWSD IWS exchange will use methods of electronic distribution, as it is collaboratively developed and as government and contract efforts are performed. The contractor shall retain this equipment as delivered by the government, until the integrated TLCDM and LWSD are delivered by the contractor, as described in Section 2.2 and under Task 2.15. All equipment shall be returned to the government at contractor cost, prior to the start of Sea Based Testing, unless otherwise requested of and agreed to by the Contracting Officer (KO) in writing. The government furnished equipment (GFE), with any associated software, reports or manuals shall be returned to the government at the completion of the contract unless otherwise requested by the Contractor and agreed to in writing by the Contracting Officer Representative (COR). In the case of electronic delivery of government furnished information, or software (GFI or GFS) return shall not be required, however all such GFI/GFS shall be deleted and erased at the completion of the contract unless otherwise agreed to in writing by the contracting officer (KO).

Item	Date Needed	Gov't POC (name /phone/e-mail)	Reference Document
Hybrid Predictive Avoidance Safety System (HPASS)	90 calendar days prior to PDR	Peter A. Morrison, SSL Program Manager/ 703-696-0553/ peter.a.morrison@navy.mil/	2
Laser Weapon Console (LWC) Station	60 calendar days after CDR	Peter A. Morrison, SSL Program Manager/ 703-696-0553/ peter.a.morrison@navy.mil/	3 & 4
Energy Storage Module (ESM), with the following capabilities: 660 KW at 450V, 60 Hz, 3-phase AC for approximately 7 minutes at a 50% duty cycle	150 calendar days prior to LT2	Peter A. Morrison, SSL Program Manager/ 703-696-0553/ peter.a.morrison@navy.mil/	6
Thermal Storage Skid (TSS) with the following capabilities: 600 gpm of water at approximately 20 deg C.	150 calendar days prior to LT2	Peter A. Morrison, SSL Program Manager/ 703-696-0553/ peter.a.morrison@navy.mil/	5
Laser Weapon Console (LWC) Simulator	30 calendar days after PDR	Peter A. Morrison, SSL Program Manager/ 703-696-0553/ peter.a.morrison@navy.mil/	
SSL Virtual Test Bed (VTB) available to support integration testing for Land Based Tests	90 calendar days prior to LT1	Peter A. Morrison, SSL Program Manager/ 703-696-0553/ peter.a.morrison@navy.mil/	

4.3 GOVERNMENT FURNISHED SOFTWARE (GFS)

The Government shall make available to the Contractor the following software as outlined in the schedule below for use during the performance of this contract. This Government furnished software (GFS), with any associated manuals shall be returned to the government at the completion of the contract at contractor cost. Modifications to the GFS shall not be made without the government's concurrence. In the case of electronic delivery of government furnished software, return shall not be required, however all such software shall be deleted and erased at the completion of the contract unless otherwise agreed to in writing by the contracting officer (KO).

Item	Date Needed	Gov't POC (name /phone/e-mail)	Reference Document
Hybrid Predictive Avoidance Safety System (HPASS)	90 calendar days prior to PDR	Peter A. Morrison, SSL Program Manager/ 703-696-0553/ peter.a.morrison@navy.mil/	
Laser Weapon Console (LWC)	30 calendar days after PDR	Peter A. Morrison, SSL Program Manager/ 703-696-0553/ peter.a.morrison@navy.mil/	

4.4 GOVERNMENT FURNISHED INFORMATION (GFI)

The Government shall make available to the Contractor the following information as outlined in the schedule below for use during the performance of this contract. Modifications to the Government Furnished Information (GFI) shall not be made without the government's concurrence. The government plans to update and share the updated information via mutually agreed to methods of electronic distribution as it becomes available and as contract efforts are performed. The contractor shall retain all GFI for the duration of the contract. This information, with any associated software, reports or manuals shall be returned to the government at the completion of the contract unless otherwise requested by the Contractor and agreed to in writing

by the Contracting Officer (KO). In the case of electronic delivery of government furnished information, return shall not be required, however all such government furnished information shall be deleted and erased at the completion of the contract unless otherwise agreed to in writing by the contracting officer (KO).

Item	Date Needed	Gov't POC (name /phone/e-mail)
Solid State Laser Mission Specific Module Interface Functional Description, version 1.1, 17 December 2014	Received 12/18/14	Vanessa Seymour, Contracting Officer/ Tel. 703-696-4591/ Vanessa.seymour@navy.mil
Hybrid Predictive Avoidance Safety Subsystem (HPASS) Interface Control Document – V1.0c, May 2013		Vanessa Seymour, Contracting Officer/ Tel. 703-696-4591/ Vanessa.seymour@navy.mil
Hybrid Predictive Avoidance and Safety System (HPASS) Increment 2.0 Interface Control Document, LDS-TM-HPASS-ICD-01004, Version 1.1, September 2014	Received 12/18/14	Vanessa Seymour, Contracting Officer/ Tel. 703-696-4591/ Vanessa.seymour@navy.mil
Solid State Laser – Technology Maturation Combat System Interface Requirements Specification, version 1.0, September 2014	Received 12/18/14	Vanessa Seymour, Contracting Officer/ Tel. 703-696-4591/ Vanessa.seymour@navy.mil
Solid State Laser – Technology Maturation Advanced Demonstration Model Combat System Interface Functional Description, version 2.0, September 2014.	Received 12/18/14	Vanessa Seymour, Contracting Officer/ Tel. 703-696-4591/ Vanessa.seymour@navy.mil
Solid State Laser Conceptual Cooling Skid Design, White Paper, 10 Jan 2014	Received 12/18/14	Vanessa Seymour, Contracting Officer/ Tel. 703-696-4591/ Vanessa.seymour@navy.mil
Interface Control Document SSL-TM Power System for Self-Defense Test Ship (SDTS) Demonstration, DRAFT, 14 May 2014	Received 12/18/14	Vanessa Seymour, Contracting Officer/ Tel. 703-696-4591/ Vanessa.seymour@navy.mil
Information Assurance Policy Update For Platform Information Technology, DON CIO Memorandum 02-10, 26 Apr 2010	Received 12/18/14	Vanessa Seymour, Contracting Officer/ Tel. 703-696-4591/ Vanessa.seymour@navy.mil
Pre-PDR Long Lead Procurement Plan Approval	ATP+45 days	Vanessa Seymour, Contracting Officer/ Tel. 703-696-4591/ Vanessa.seymour@navy.mil
Post PDR Long Lead Procurement Plan Approval	PDR+30 days	Vanessa Seymour, Contracting Officer/ Tel. 703-696-4591/ Vanessa.seymour@navy.mil
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5.0 ACRONYMS

Acronym	Definition
AMSE	Auxiliary Mission Support Equipment
ATO	Authority to Operate
BASA	Beam Alignment and Stabilization Assembly
BBA	BDS Ball Assembly
BCS	Beam Control Subsystem
BDS	Beam Director Subsystem
BEA	BDS Electronics Assembly
BGA	BDS Gimbal Assembly
BPA	Bent Pin Analysis
BTA	Beam Transfer Assembly
CCB	Configuration Control Board
CDR	Critical Design Review
CSCIs	Computer Software Configuration Items
CSCs	Computer Software Components
CSUs	Computer Software Units
D&D	Design & Development
ECRs	Engineering Change Requests
EDI	Electrical Design Integration
EMCA	Engagement Management Controller Assembly
EMI/EMC	Electromagnetic Interference/Electromagnetic Compatibility
EMSW	Engagement Management Software
ESM	Energy Storage Module
FA&T	Fabrication, Assembly, and Test
FAC/FIAC	Fast Attack Craft/Fast Inshore Attack Craft
FCS	Fire Control Subsystem
FHA	Functional Hazard Analysis
FMECA	Failure Mode, Effects, and Criticality Analysis
FRB	Failure Review Boards
FTA	Fine Track Assembly
GFE	Government Furnished Equipment
GFF	Government Furnished Facilities
GFI	Government Furnished

Acronym	Definition
GPS	Information position services
GSE	Ground Support Equipment
HAZMAT	Hazardous Material
HEL	High Energy Laser
HERO	Hazards of Electromagnetic Radiation to Ordnance
HHA	Health Hazard Analysis
HPASS	Hybrid Predictive Avoidance and Safety System
HTS	Hazard Tracking System
HWAS	Hard Wired Abort System
I&T	Integration and Test
IA	Cybersecurity
IATO	Interim Authority to Operate
IATT	Interim Authority to Test
IBR	Integrated Baseline Review
ICDs	Interface Control Documents
IMP	Integrated Master Plan
IMS	Integrated Master Schedule
IPT	Integrated Product Teams
ISA	Integrating Structure Assembly
ISR	Intelligence, Surveillance and Reconnaissance
KPP	Key Performance Parameters
LaWS	Laser Weapon System
LBCA	Laser Beam Combiner Assembly
LBT	Land Based Testing
LMA	Laser Module Assembly
LOS	Line-of-Sight
LPCA	Laser Controller & Power Assembly
LRU	Line Replaceable Units
LS	Laser Subsystem
LSE	Lead System Engineer
LSRB	Laser Safety Review Board
LWC	Laser Weapon Console
LWSD	Laser Weapon System Demonstrator
M&S	Modeling and Simulation
MDI	Mechanical Design Integration
MGSE	Mechanical Ground Support Equipment

Acronym	Definition
MLD	Maritime Laser Demonstrator
MRB	Material Review Boards
MSM	Mission Specific Module
MSMs	Mission Specific Modules
MTEP	Master Test and Evaluation Plan
NDI	Non-Developmental Items
NEPA	National Environmental Policy Act
NG	Northrop Grumman
O&SHA	Operating and Support Hazard Analysis
ONR	Office of Naval Research
OQE	Objective Qualifying Evidence
PCS	Power & Cooling Subsystem
PDR	Preliminary Design Review
PFS	Principal for Safety
PHA	Preliminary Hazard Analysis
PRA	Platform Information Technology Risk Acceptance
RMMP	Risk Management and Mitigation Plan
ROMB	Risk and Opportunity Management Board
RSO	Range Safety Officer
RVTM	Requirements Verification Traceability Matrix
SAR	Safety Assessment Report
SBT	Sea-Based Testing
SDD	Software Design Document
SDTS	Self Defense Test Ship
SEIT	System Engineering, Integration and Test
SHA	System Hazard Analysis
SLOC	Source Lines of Code

Acronym	Definition
SOW	Statement of Work
SRHA	System Requirements Hazard Analysis
SRR	System Requirements Review
SSAR	System Safety Assessment Report
SSHA	Sub-System Hazard Analysis
SSL	Solid State Laser
SSPP	System Safety Program Plan
SSS	Structure and Support Subsystem
SSSTRP	Systems Software Safety Technical Review Panel
SSWG	System Safety Working Group
STE	Special Test Equipment
T&E	Test and Evaluation
T&ES	Test & Evaluation Strategy
TCA	TTS Controller Assembly
TDP	Technical Data Package
TEMs	Technical Exchange Meetings
THA	Harness Assembly
TIL	Track Illuminator Laser
TLCM	Tactical Laser Core Module
TPMs	Technical Performance Metrics
TRR	Test Readiness Review
TSAR	Temporary Ship Alteration Record
TSID	Test Ship Installation Drawing
TSS	Thermal Storage Skid
TTS	Targeting and Tracking Subsystem
UAV	Unmanned Aerial Vehicle
WBS	Work Breakdown Structure
WSESRB	Weapon Systems Explosive Review Board